The

Electrical Review

VOL. CIII. AUGUST 10, 1928. No. 2,646.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE M.I.E.E., A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

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Telegraphic Address "AGEEKAY, CENT., LONDON," Code, A B C. Telephone No.: Central 8871 (5 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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Rural Electricity Supply.

THE two weeks which have elapsed since the publication of the report of the proceedings of the Conference on Electricity Supply in Rural Areas have sufficed for the formation of certain impressions of the contents of this interesting and instructive Blue-book. Its publication is most welcome at the present juncture, for it crystallises the present position in this country, and hence should be carefully studied by all who are interested either in the distribution of electricity, or in the manufacture of electricity-consuming devices. To the prospective consumer it is a little disappointing, in that his chances of getting an immediate supply do not appear too rosy; indeed, it would also be disappointing to many others if it were not for the saving clause that the Conference is to meet again in a year's time to continue its work and to consider the action taken meanwhile upon its recommendations. As the report stands, it is insular in character and conception, for only the elementary experience of England is taken into account, and but a small part of that; whereas the report would have been much more effective if it had taken in the whole of Great Britain and also the broader point of view of the best experience of the world, coupled with bold vision of the possibilities of future progress.

At the same time, complaint cannot be made that the members of the Conference did not make some very drastic recommendations, which will do much to repair their omissions. Nevertheless, a notable omission is any recommendation for the equipment of farms of various sizes in different parts of the country to serve as examples of what an ideal installation would be, on the basis of what would be carried out by the farmer himself if he had had, say, twenty years' experience of the use of electricity and was fully aware of the use agriculturists in other countries were making of the aid of electricity. None of the numerous farms cited in the appendix can really be termed "electrified" in the true sense of this expression.

Though the publication consists of 84 pages, it should be realised that it does not contain even a tithe of the data which were prepared, regardless of cost and time, by the various members of the Sub-Committees, and also by the Electricity Commissioners. One of the most

striking facts brought to light is that about 2,270 farms are already connected to the public electricity supply mains, in addition to over 500 farms which have their own private generating plant, which shows that the British farmer realises how valuable a supply of electricity is to him as an aid in his work. This number is an enormous increase upon the figure available only a few years ago, and augurs well for the future. According to this report, British farms are potential consumers of from 4,000 to 14,000 kWh each per annum.

The tables in the appendices deserve careful inspection. From these it is evident that the British farmer is encouraged to use electric light rather than power to any serious extent. The paucity of the power supply is undoubtedly due to lack of technical knowledge of its applications, on the part of the engineering staffs of the electricity supply undertakings, British manufacturers, and farmers themselves—hence the need for education of all parties concerned.

Of course, the controversial question of tariffs is touched upon, the conclusion being reached that there is no material difference in preparing tariffs for either rural or urban use. In these days of thermal storage for water heating, cooking, &c., the Conference does not seem to have realised that the day even of the fairly modern two-part tariff has almost passed in favour of a multi-part tariff; further, the bearing of the various "change circuit" systems on the matter does not seem to have been comprehended.

It has been assumed that the cooker which seems indigenous to this country—with its awkward maximum demand of 6 to 8 kW and doubtful diversity factor—will also be employed for rural purposes. This principle should receive further consideration, for it would seem that a modern form of thermal storage cooker is better suited to the conditions of rural distribution of electricity.

Practically no attention has been given to systems of distribution, as such, apart from pointing out the very high cost of construction under the present Regulations. A good modern system will in itself considerably reduce the cost of distribution.

A copy of this publication has been forwarded officially by the Electricity Commissioners to every authorised electricity supply undertaking, and it is to be hoped that, in addition, it will have a very wide general circulation, for, in spite of the above somewhat adverse comments, it will afford much stimulating food for thought; the more the people who read it the more quickly will rural electrification progress, for it is a valuable means for getting many minds to concentrate upon the subject, and thus ensuring the success of rural electrification with its enormous potential load.

The Cable and Wireless Report.

In our "Parliamentary News" this week there appears a brief report of Sir John Gilmour's statement of the Government's reasons for adopting the report of the Imperial Cable and Wireless Conference which was dealt with in our last issue. He stressed the fact that wireless communication would not be able to fulfil all requirements for many years to come, for the cables possessed several attributes which made them essential. He was of the opinion that the carrying out of the proposals would be a very good bargain for the Empire, and the Government had decided to adopt the report and to give effect to its recommendations immediately. Sir John further said that a remarkable degree of unanimity had been displayed by the Dominion Governments. All of them approved the proposals in principle, although some matters of detail were considered by some of them to require further attention. South Africa, for instance, considers that State control of the combined services should be assured, while Canada and Australia call for the clarification or amplification of some details.

An allied matter of interest to which we may draw attention is the letter published by Marconi's Wireless Telegraph Co., Ltd., which is mentioned in our "City Notes." This clears up a number of misapprehensions regarding the projected merger of the company with the cable companies.

Better Factory Lighting.

One of the most encouraging features of the latest Factory Inspectors' reports is the recording of the manifest desire of owners and managers of factories and workshops to improve their lighting. There must be very few indeed who do not believe that better lighting means increased output, better work, more contented employés, and many other desirable improvements, and there are only two things which stand in the way of this betterment: they are ignorance and false economy. Investigations have shown that very many industrialists (especially among the smaller ones) are actually not aware that there is anything better than a gasfilled lamp with a conical shade, and they are perfectly willing to try scientifically-designed fittings when their attention is drawn to them. Others look upon extra money spent upon lighting as a dead loss, or unnecessary extravagance, not realising that inefficient illumination, like inefficiency of any other kind, is wasteful and often harmful. It is principally towards these two classes of factory owners that the E.D.A. Factory and Workshop Lighting Campaign is directed, and very striking facts and figures have been collected and will be effectively used to convince them of the error of their ways.

The organisers maintain that 70 per cent. of our factories and workshops are employing obsolete fittings, while many of the remaining 30 per cent. are using modern fittings improperly. If this is true, and there seems to be no reason to doubt it, there is tremendous scope for improvement.

In factory lighting, even more than in other applications, "Electricity saves more than it costs."

Factory Accidents.

The annual report of H.M. Chief Inspector of Factories and Workshops for 1927, which is abstracted elsewhere in this issue, deals at somewhat greater length than has been customary in recent years with accident prevention, a subject that is receiving much attention at the moment in industrial and domestic spheres alike.

The work of this branch of the Home Office is steadily increasing in volume and complexity, but the year's feature of outstanding interest is considered to be undoubtedly the opening of the Industrial Museum in London. Experience has proved that much of H.M. Inspectors' time spent in active work at factories is occupied in explaining to factory occupiers, works managers, and foremen the construction and operation of safety devices for different kinds of machinery and the means of observance of the many codes of Regulations, &c. In this respect the Museum should be of great assistance, since it offers to those directly concerned the opportunity of solving their own problems by personal inspection of the exhibits therein displayed.

The chapter devoted to the report of the senior electrical inspector, Mr. G. Scott Ram, O.B.E., M.I.E.E., is an indication of the variety of problems which have to be dealt with, and his observations on the trend of modern developments from the safety point of view are sound. The circumstances under which reportable accidents occur are instructive, and it is gratifying to learn that the advice and assistance of area inspectors is being sought with increasing frequency prior to the initiation of new work and the installation of machinery, which common-sense policy has been proved to save money in that it avoids the necessity for alteration and modification after completion; indeed, investigation so initiated has even resulted in the improvement of processes.

Primary Wet Cells.

A brief review of past and present practice, and an outline of experiments leading to the development of the "Codd" electric battery cell.

By A. MORTIMER CODD, F.Ph.S.

PROFESSOR Ayrton used to tell his students that whoever could invent a perfect primary cell would "become rich beyond the dreams of ordinary avarice. We imagine most students of electricity have at one time or another dabbled with primary cells, and we do not claim to be an exception, but without pretending to have discovered a perfect cell, we believe the outcome of the experiments outlined in this article have resulted in a single-fluid wet cell of novel design and considerable commercial utility.

In starting out to experiment, to compare and, if possible, to improve, it is as well to tabulate the desirable points of a cell, which are as follows:—

(1) Large electromotive force.
(2) Low internal resistance.
(3) Constancy.
(4) Small local action.
(5) Cheapness.
(6) Preferably a single fluid.
(7) Simplicity and absence of mess.
(8) Ease of recharge.
(9) Freedom from poison, odour, &c.

In considering these points we find that sometimes two or more are interconnected and that a balance must be struck between them. High e.m.f. is not only desirable because it diminishes the number of cells necessary for a given voltage, but also because for a given consumption of zinc the cell with the higher e.m.f. will give a proportionately higher output. Low internal resistance is also essential if the current required is heavy, but usually the currents taken from primary cells are not so large as those expected from accumulators, and the best efficiency will result when the resistance of the cell or cells is comparable with the resistance of the external circuit.

The property of constancy of efficiency of depolarisation is more or less desirable, according to whether the cell is to be used on continuous or intermittent work. Naturally, for occasional bell ringing, good depolarisation is not essential, whereas for lighting glow lamps and similar work the reverse is true. Again, the question of low local action is unimportant should the cell only be in use for a few hours, but as most cells exist for a long period on open circuit with only relatively short working periods, the desirability of small local action becomes an important point, because more zinc and excitant may be used over a long period of inactivity in local action than are actually consumed in useful work.

Cheapness is more particularly to be sought in cases where large numbers of cells are used commercially, and the cost of chemical excitants, depolarisers, and so on, may in the aggregate amount to a large figure. The necessity of cheapness is again reflected in (6), (7) and (8) as a question of labour or handling. Thus in isolated positions the necessary refills for the cells may have to be transported long distances, hence simplicity makes for cheapness.

Our experience as detailed hereunder has led us to the conclusion that a cell to be of commercial utility must have only one fluid as an excitant, and, if necessary, as the depolariser. The use of two fluids not only means storage and handling of two chemicals with the resultant mess, but also the use of a porous pot or its equivalent with a consequent rise of internal resistance. The ideal of simplicity would be two electrodes and the electrolyte only; such a cell could be easily recharged by unskilled labour at a minimum cost. Since such cells may pass through unskilled hands in commercial or domestic use, it is obvious that the electrolyte must be relatively non-poisonous and otherwise inoffensive.

Having outlined the requirements we come to the question of a standard test for the cells with which we propose to experiment. At the moment the standard test most usually employed is to discharge the cell through a resistance of 10 ohms. Now it would obviously be as ridiculous to discharge a small flash-lamp cell through 10 ohms as it would be, on the other hand, to test a 100-ampere-hour starter secondary cell with a similar load. By this is meant that the 10-ohm load does not take into account the capacity, or cubic contents, of the cell. A cell of high e.m.f. is penalised for a good quality as compared with a similar cell of lower e.m.f., since the cell of higher e.m.f. tends to discharge its energy at a quicker rate than the cell of lower e.m.f. Further, a cell of high internal resistance, in itself a possibly undesirable feature, scores over a similar cell of low internal resistance. Hence, it would seem desirable that some rule should be evolved having regard (*a*) to the cubic capacity of the cell tested, (*b*) to the e.m.f. of the cell, and (*c*) to the i.r. of the cell. Thus the resistance load might be 8 ohms per volt e.m.f. per quart cell, so that with this arrangement the load for a Leclanché-type cell of 1.5 volts and of one quart capacity would be 12 ohms, and if of 4 pints capacity 6 ohms. Similarly, a quart bichromate cell would be loaded with 16 ohms at 2 volts, or a 4-pint cell with 8 ohms. As, however, a 10-ohm load is the usual test it has been accepted in the following experiments as the standard arbitrary unit.

For purposes of classification cells may be divided into three classes:—True single-fluid cells; two-fluid cells; and single-fluid cells with a solid depolariser. The whole success of any form of cell turns upon the suitable choice of the depolariser for the type of cell with which we are working.

Excluding mechanical and air depolarisers for the time as too feeble and uncertain, we come to the more generally known and useful substances enumerated as follows:—Liquid: nitric acid, copper-sulphate and nitrate, mercury-sulphate, permanganate and bichromate of potash or soda and chromic acid, and ferric chloride. Solid: manganese dioxide, copper oxide, and lead peroxide. Haloid: chlorine, iodine, and bromine.

Nitric acid, although a good depolariser, is too offensive and dangerous for practical purposes. Considerable time was devoted to copper-sulphate in the form of Daniell cells, but the insuperable difficulty was the deposition of copper on the zinc electrode, whether as a gravity cell, or when using a porous pot; the cell is also relatively feeble. By substituting caustic soda for zinc-sulphate, the difficulties are to a great extent overcome, and there is also a considerable rise in the voltage (1.65 approx.). The use of copper-nitrate enables a much more concentrated solution to be made than can be effected with copper sulphate, and there is also a small gain in voltage (1.72 approx.). A cell of this kind is cheap and easy to set up if we accept the use of the caustic soda; it is also very constant and gives a reasonably powerful current. Unfortunately on open-circuit work for more than a few weeks it is useless owing to the usual trouble due to diffusion of the excitant from the zinc compartment outwards; also the porous pot tends to disintegrate, as

is always the case when used to contain an alkaline solution in the presence of a salt or acid solution.

Mercuric-sulphate, when used with certain vehicles as excitant, forms a very pleasing simple cell having an e.m.f. as high as 1.75 V, but unfortunately its life is not long in view of the high cost of mercury salts, which are also very poisonous. The single-fluid bichromate cell is, we suppose, the amateur's sheet anchor, but under quantitative tests it does not show up well, and its initial high voltage is to a great extent illusory.

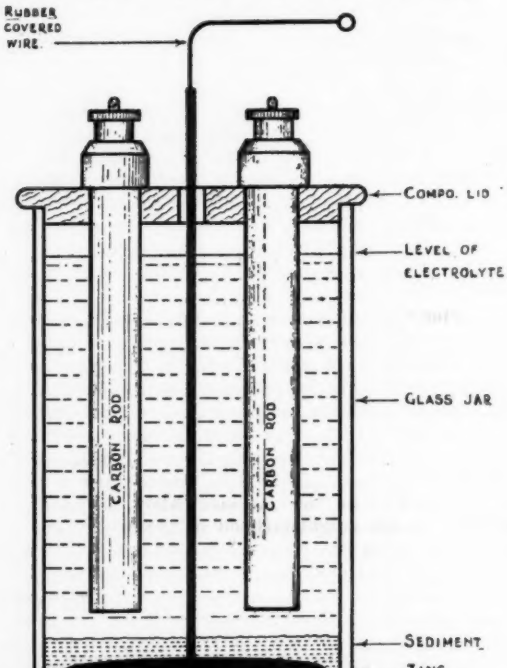


Fig. 1.—General Arrangement of "Codd" Cell.

Made up as a single-fluid cell with ordinary salts to replace the somewhat violent use of sulphuric acid, its first powerful current soon falls off owing, apparently, to a deposit of chromium salt scum on the zinc; indeed, we were unable by using any combination of salts in conjunction with chromic acid, or bichromate of potash or soda, to obtain reasonable results from a cell for open-circuit work. These remarks also apply to a certain extent to the Fuller form of bichromate cell, the great difficulty in this case being the tendency of the excitant surrounding the zinc to fall and the diffusion of the chromium salts into the zinc compartment of the cell. These tests included the use of caustic soda in the zinc compartment (Bleeck-Love cell, e.m.f. 2.56 V approx.). Various types of gravity bichromate cells were also tried without much success.

The substitution of potassium permanganate gives a rather higher initial voltage, but coats the zinc with a slime of manganese, so that the current soon falls off. Added to this difficulty, potassium permanganate is not easy to dissolve in any great quantity. Using potassium permanganate as in the Dun cell, with caustic soda round the zinc, the e.m.f. is 2.72 volts approx., but the same difficulties supervene.

We now come to those types of cell which employ a solid depolariser, the most important of which is the Leclanché. In 60 years this cell has been vastly improved from the original feeble model, and it seems unlikely that it can be bettered, except in detail improvements. Its chief defect, apart from evaporation, creeping, furring of the terminals and the formation of non-conducting zinc oxy-chlorides within the depolariser and the carbon itself, is the low p.d. at which the main volume of the current is given, this being in the neighbourhood of 1 volt and under. Further, even allowing the useful life of the cell to terminate at as low as 0.75 volt, a considerable amount of potential energy has to be thrown away because it is not available at a useful electrical pressure. Despite these disadvantages, the cell has a wide field of usefulness, particularly in the form of the popular "dry" cell, in itself a specialised article.

In contrast with the Leclanché cell we have the Lalande cell, employing as depolariser copper oxide in a solution of caustic soda. This cell is extraordinarily constant and capable of giving powerful currents, but its e.m.f. is extremely low and caustic soda is a very unpleasant substance to handle. This cell has some popularity on the North American Continent, owing to its low freezing point when used in exposed positions. We have had no success in experiments with the object of raising the e.m.f. of this cell. Lead peroxide has been used as a depolariser in various cells, both single- and double-fluid. As a single-fluid cell in dilute sulphuric acid with amalgamated zinc as the anode an e.m.f. of 2.5 V is obtained. We have used lead peroxide in dilute acid in conjunction with a porous pot containing zinc in caustic soda solution, obtaining an e.m.f. of 3.14 volts, but the porous pot soon disintegrates. Lead peroxide cells have generally a high e.m.f. and low internal resistance, but their output, though powerful, is relatively small, and the high price of the peroxide militates against their extended use. Experiments to utilise the halogens as depolarisers met with little success. Chlorine naturally does not lend itself to commercial uses as such. Iodine, although showing some promise, is out of court on account of price. A solution of bromine in caustic soda gave very good results (e.m.f. 1.94 V), but was abandoned owing to the extreme undesirability of the two components.

There remains only now to be considered the last depolariser on our list, *viz.*, ferric chloride. As far as we can discover, ferric chloride was first mentioned by Figuier in 1863, in conjunction with ferric sulphate. Since then it has been used by Pabst, Paine, Maron, Duchemin, d'Arsonval and recently by Darimont. Of all the depolarisers examined, this substance stands out for relatively high e.m.f. and tenacious constancy of depolarisation, with which it also combines the function of excitant, cheapness, solubility, freedom from evaporation, and inoffensiveness and general docility of handling; its only defect is that its conductivity is not very good, especially as a concentrated solution. Early experiments on the lines of Figuier's cell gave good results from the point of view of voltage and current, but it proved useless as an open-circuit cell, since zinc aluminium and iron are all violently attacked. On this account it seems imperative to use a porous pot. The first double-fluid cell tried consisted of carbon in ferric chloride, and an amalgamated aluminium rod in sodium or potassium carbonate. Such a cell gives an e.m.f. of 2.12 V (approx.), is reasonably constant and might have a long life were it not that the aluminium grows round it an oxide which eventually bursts the porous pot.

The next step was to substitute zinc for the aluminium, and cautic soda or potash for the carbonate. A very similar e.m.f. was generated, but trouble was experienced from the falling of the soda in the porous pot. It is to be supposed that the porous pot is really a mesh of poor conducting material enclosing numerous cavities, and that within the interstices of the labyrinth contained in the walls of the pot the two chemicals meet and effect combination, while at the same time the ions are free to circulate. In order to effect isosmosis, it seemed to be clear that if the pores of the pot could be filled up with conducting matter the problem would be solved. At first it was found that the carbonate of soda and ferric chloride formed a well-defined membrane of rust within the porous pot, in fact this membrane tended to raise the i.r. of the cell and to disintegrate the pot. Subsequent efforts were made to attain the same result without spliting the pots by impregnating them with zinc chloride, gelatine, soap solution, and so on, but without any definite success, and thus this second cell was abandoned. It should be

realised that these experiments have extended over some seven years, and during that time we were ignorant of Darimont's experiments in creating the semi-permeable membrane by the use of chalk suspended in a mucilaginous solution of sodium chloride and corn-flour.

Having abandoned the use of soda solutions within the porous pot without regret, we next tried the effect of various salt solutions. The voltage of such cells fell to about 1.5 volts, the drop being attributable to the absence of the Becquerel effect at the porous pot between the ferric chloride and the alkaline solution. Of the salts tried, the best results were given by the chlorides of magnesium, sodium, zinc, and ammonium. During these experiments it was noticed that with certain salts, although generally the solution in the porous pot fell, in certain cases it would rise, and further investigation showed this to be due to the relative strengths of the two electrolytes; thus, when the solution in the zinc compartment was the stronger it would rise and when weaker fall. The correct strengths of depolariser and excitant appear to be such that when the ferric-chloride has a specific gravity of 1,400, that of the zinc-chloride should be 1,600. Under such conditions a state of balance or isosmosis will generally be set up. Such a cell gives a very good output, and several of these cells were put on a working circuit, but at the end of some months it was found that although the bulk of the cells were in good condition, others had for unknown reasons suffered an interchange of the electrolytes, thus ruining the cells. At this stage the fact was realised that although the cells enumerated above were suitable for laboratory purposes extending over a period of perhaps a month, they were unsuitable for protracted open-circuit work, and that the porous pot must be abandoned for commercial purposes.

We are now at the stage in which we have to make a single-fluid cell, and have given the data showing that ferric chloride is probably the best depolariser. Now it is known that ferric chloride will attack most of the common metals, a fact we have verified, the only metal not attacked being lead, which gives an e.m.f. of rather over one volt. Current, however, cannot be drawn from a carbon-ferric chloride-lead cell for more than a moment, owing to the formation of a non-conducting skin of lead chloride on the surface of the lead plate.

The next step was to attempt to form some alloy with the lead, so as to render it sufficiently responsive on closed circuit, yet so that the lead chloride would form a protection against local action when the cell was idle. Large numbers of alloys were tried in various combinations, the most successful being an alloy of 7 parts of lead and 3 parts either of tin or of cadmium. With a plate roughly cast about 6 in. long and 1¾ in. wide sandwiched between two similar carbon plates, a two-pint cell having an initial e.m.f. of 1.05 V ran 380 hours, discharging through 10 ohms, before the p.d. fell to 0.5 volt. The initial short-circuit current was 5 amperes. Such a cell can be recommended for giving a reasonably powerful and constant current for laboratory use.

Unfortunately on open circuit there is some local action which the lead-chloride does not altogether prevent. With the idea of further preventing local action we next cast a circular plate of alloy, placing it at the bottom of the cell with the carbon suspended over it. It was then found that such a cell failed to give the watt-hour output it should have done, unless intervals of rest were afforded between the discharging periods. On transferring the cell to a glass jar it was noticed that with the tin-lead alloy a clear zone appeared in the neighbourhood of the anode, and that when this was agitated the cell would again work satisfactorily. Clearly the action of the electrolyte on the alloy formed some poorly conducting liquid which lay at the bottom of the jar and impeded the normal working of the cell.

Since the disk of alloy, when placed at the bottom of the cell, seemed able to create, as it were, a circumambient liquid, protective to the point of non-conductivity, it seemed reasonable to try a plate of plain zinc. A cell so constructed gives extraordinarily good results and only small modifications have been necessary to bring it to its present commercial perfection. From the sketch, fig. 1, it will be seen that the completed cell consists of a glass vessel at the bottom of which lies a zinc plate, roughly shaped to the configuration of the base of the vessel, to which is attached a rubber-covered wire. The mouth of the container is covered with a lid from which hang one or more carbon plates dipping into the electrolyte. The number of carbon plates, or rather their area, depends on the i.r. of the cell required. For fairly heavy currents a large area is desirable. The e.m.f. of such cells is approximately 1.52 V, and the internal resistance of a cell containing 1½ pints of electrolyte about 0.6 ohm.

In cells of this type, intended for open-circuit work,

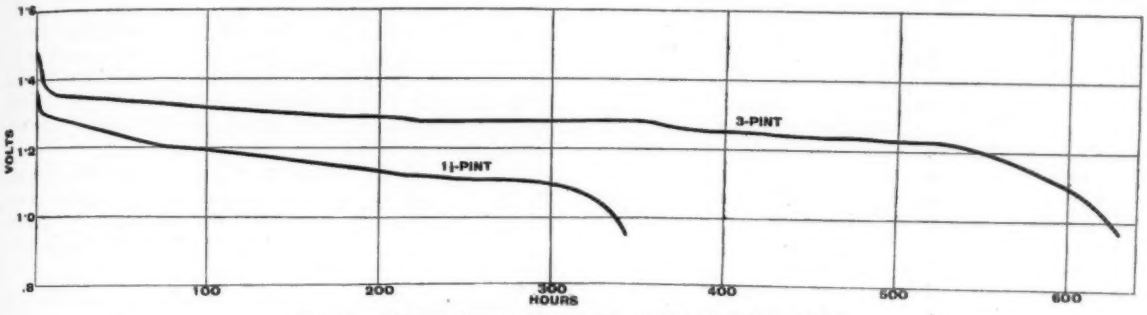


Fig. 2.—Output Curves for 1.5- and 3-Pint "Codd" Cells.

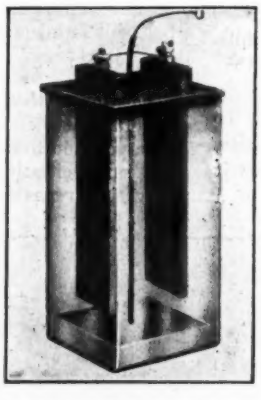


Fig. 3.—"Codd" Cell Complete.

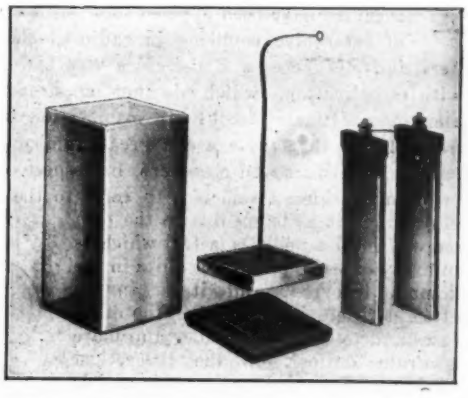


Fig. 4.—Component Parts of "Codd" Cell.

it is better to add a little free mercury to amalgamate the zinc plate; amalgamation of the plate when cast with mercury does not give such good results, nor does the addition of mercury salts to the electrolyte. The action of the cell appears to be as follows:—When the ferric-chloride solution is first emptied into the cell it attacks the zinc plate. Zinc chloride is then formed which, owing to its greater density, lies at the bottom of the cell, thereby protecting the zinc when on open circuit. On closing the circuit, however, the action continues until the whole of the ferric-chloride is reduced, at which point it assumes a watery yellow colour. For open-circuit cells, in order to prevent convection currents disturbing the layer of zinc chloride, it is useful to mix with the electrolyte a certain amount of sand, or the like; thus, when the solution is emptied into the container the sand eventually falls to the bottom, forming, as it were, a mobile porous pot within whose interstices the zinc-chloride can find refuge, with no danger of being disturbed by circulating currents of ferric chloride. Cells of this description give a remarkably constant and high p.d. on reasonable loads, and recover their original pressure rapidly after being short-circuited, showing that depolarisation is very complete.

The output curve of any particular cell repeats itself on recharge with remarkable fidelity, so that the output of any cell under similar conditions can be absolutely relied upon. Local action on open circuit seems small, the consumption of zinc being about 1.3 grammes per ampere-hour. Fig. 2 shows output curves of 1.5- and 3-pint "Codd" cells. When the cell is taken apart for cleaning or recharging the zinc will be found clean and there will be an entire absence of the stony or crystalline deposits with which we are familiar in other cells; indeed, it is sufficient to rinse the parts momentarily under the tap and reassemble. The cost per recharge is relatively cheap, and 24 Ah per pint of solution or about 29 watt-hours can be relied upon, the mean p.d. being in the neighbourhood of 1.2 V at a reasonable output. The cell is almost completely exhausted when the p.d. approaches 1 volt, so there is no waste of electrolyte, thanks to the whole current being given at a useful working voltage. The solution does not evaporate appreciably during 6 months' use on intermittent circuit.

Owing to the strong depolarisation of the electrolyte during use the cell does not recover a high momentary voltage after periods of rest. On this account there is less risk of burning out lamp bulbs or valves when switched on after periods of inactivity.

Altogether it is believed that this cell has a position of considerable utility intermediate between the accumulator on the one hand, and Leclanché and Daniell cells on the other.

Figs. 3 and 4 show, respectively, a complete "Codd" cell and its component parts.

Radio Valve-Anode Capacitive Resistance.

The theory and operation of capacitive resistance in valve-anode and other circuits has for its consideration the fluctuating potential across a fixed resistance when such varying voltages are due to changes of other resistances in the circuit and not to fluctuation of the initial applied potential; the author maintains that the present practice of treating such problems as comparatively simple a.c. cases is incorrect when effective capacity is present.

By ERNEST W. BRAENDLE, A.M.I.E.E.

IT may be said that the usual alternating-current formulæ have been applied successfully in the case of intervalve coupling in radio-telephone amplifiers and elsewhere, and therefore why bother further with complications which do not apparently greatly affect the ultimate result? In extenuation it must be pointed out that there are a great number of effects, both in amplifiers and elsewhere, in respect of which it is often considered sufficient to refer to the lack of a desired result as being due to the presence of local capacities, a fact which is in many cases true, but not quite in the manner inferred, and it is in an attempt to elucidate some of the other cases and to create a broader and more accurate outlook on the theoretical workings of amplifiers that this article has been written.

So often does one hear the term "alternating" employed in relation to the changing currents set up in these circuits that it may be as well to commence by defining exactly what the author considers is involved by the term "alternating" as applied to electrical circuits. For a current to be considered as "alternating" it is not necessary for the terminals of the source of supply to reverse their sign, *i.e.*, to become alternatively positive and negative, as in the case of a supply from an a.c. generator, but the pressures, or potentials, of the source of supply must increase and decrease alternately in order that the current may flow both into and out of the circuit by the same path. In the case of fig. 1 we have a circuit comprising resistance in series with a condenser, fed by an a.c. generator, with the resultant characteristic suggested in fig. 1*a*. It will be seen that the condenser is therefore in a position to accept a charge, discharge itself through the same circuit, and recharge itself in the opposite direction repeatedly. Under such conditions the condenser is said to offer reactance to the current equal to $\pm 1/2\pi FC$, where F is the frequency in cycles per second and C is the capacity in farads, and it must be clearly understood that a condenser cannot "pass" any current whatsoever, except that due to leakage.

Fig. 1.

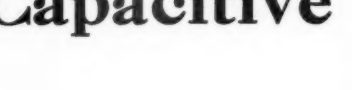


Fig. 1a.

In fig. 2 the same components are shown fed from a variable d.c. source of supply which will give a graphical result as suggested by fig. 2*a*. In this case, although no actual reversal of the input potential takes

place, it is seen that at one moment the condenser will assume a potential equal and opposite to the maximum of the source of supply, and the potential of the source of supply falling will permit the condenser to discharge itself, since it will then be at a higher potential, and since current may be said to be passing backwards and forwards through the same circuit, the conditions may be said to be alternating and the same formula is therefore applicable.

In fig. 3, however, a source of constant d.c. is shown feeding a condenser through a variable resistance. It will be observed that after the completion of the transient condition, *i.e.*, as soon as the condenser is fully charged, no amount of variation of the resistance will have the slightest effect, since the condenser will have assumed a potential equal and opposite to that of the source of supply and no current will therefore flow in the circuit, giving a graphical result suggested in fig. 3*a*, which can in no sense be said to represent the conditions for an alternating current.

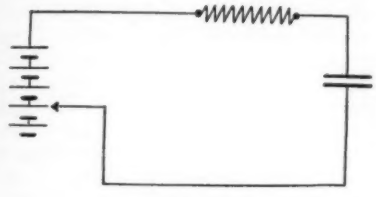


Fig. 2.

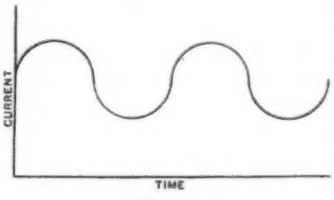


Fig. 2a.

If now the condenser in fig. 3 is shunted by means of a resistance R, as shown in fig. 4, although the condenser cannot discharge itself through its source of supply, it is yet possible for it to discharge through the resistance with which it is in parallel, should the resistance in the supply increase and thereby cause a limitation of the current required to maintain the original potential across the condenser and its attendant leak. If, therefore, the input resistance is varied in a sinusoidal manner, causing a corresponding fluctuation of current flowing in the circuit, it will be appreciated that current flows only into the circuit from the source of supply and, so far as the charge in the condenser is concerned, is being dispersed through the resistance R. Such a condition would mean that the average current supplied would be greater, within limits, for a given variation of r as the capacity of C is greater, since the tendency of C is to absorb its maximum potential when r is decreasing to a minimum and to maintain such a potential during the remainder of the cycle of r, thereby maintaining a higher mean current through the resistance R. This is suggested by the graphical fig. 4*a* and, since the current can in no way be said to flow into and out of the circuit through its source of supply, the conditions cannot be said to be those of an alternating current; therefore, the usual reactance formula is inapplicable. This condition is by no means altered if the capacity is considered as being in parallel with the variable resistance as in fig. 5; the only difference from an electrical point of view is a reversal of operations, resulting in the same effect; that is to say, the capacity in this position tends to discharge itself whilst r is small and recharge itself through R as the resistance of r increases, and since this means that the tendency of the potential across r is to decrease, and inversely for that across R to increase, the result may be said to be the same. Since the usual reactance formulæ are not applicable, how then are these charge and discharge conditions to be considered? At the moment a formula does not appear to be available, but it is suggested that this will be dependent on the relative values of the input and output "time-constants" in combination with the frequency and amplitude of change in r and also the initial potential applied by the steady direct-current source; for this reason the meaning of "time-constant" is briefly surveyed. By the "time-constant" of the combination of a capacity and a resistance is meant that time which will elapse before a condenser of given capacity will lose or gain a given percentage of its charge through a leak of given resistance, the formula for which is:—

$T = \log_e 1/a \times CR$, wherein T = time in seconds; a = percentage of charge remaining, expressed as a decimal (*viz.*: 80 per cent. = 0.80); C = capacity in farads; R = resistance in ohms; and e = base of naperian logarithms.

It is pointed out that when the percentage of the charge remaining is 36.8 per cent., then this may be expressed by $T = \log_e 1/0.368 \times CR$, wherein the constants are as before; but 1/0.368 is equal to the constant e, and since the log of e to the base e is unity, then the formula becomes such that $T = CR$. If now we consider the original formula, it will be seen that $a = e^{-T/CR}$, and the curve (fig. 7) is based on this as denoting the change in a for a change in R, one curve representing the percentage of charge lost and the other the percentage of charge remaining in the condenser, in a given time and for a given capacity. This serves to show that the slope of the curve can only be considered as linear within very narrow limits, about the point where the second differential of the equation is equal to zero, *i.e.*, when:—

$$\frac{T(T-2CR)}{C^2 R^4 e^{\frac{T}{CR}}} = 0,$$

which is only true when $R = T/2C$.

On either side of this point the curve is not linear, and it is reasonable to expect that some form of rectification might be evident if the value of R were varied sinusoidally about the points of maximum rate of change of the slope of the curve, or, in other words, when the third differential is equal to zero, *i.e.*, when:—

$$\frac{T(6C^2 R^2 - 6TCR + T^2)}{CR^6 e^{\frac{T}{CR}}} = 0.$$

which is only true when $6C^2 R^2 - 6TCR + T^2 = 0$, *i.e.*, when $R = T/(3 \pm \sqrt{3})$ C, the capacity C being provided with either a constant resistance in its source of supply, or in its path of discharge, as the case may be. That is to say, if C (having a constant path of discharge) is fed through a sinusoidally-varied resistance in its source of supply, or inversely a constant resistance in its source of supply and a sinusoidally-varied path of discharge, then C will either gain more than it loses, or lose more than it gains.

Since for the general condition under consideration the mean of the variable resistance r (figs. 4 and 5) should at any rate approximate to that of the fixed resistance R, and provided that the relation between the time-constant of the capacity C and the fixed resistance R and the frequency with which r is varied is such that the value of T is equal to, or greater than, the product of C and R, then the point at which the maximum rectification might be expected is when r (mean) $= T/(3-\sqrt{3})$ C, although rectification can take place on either side of this point.

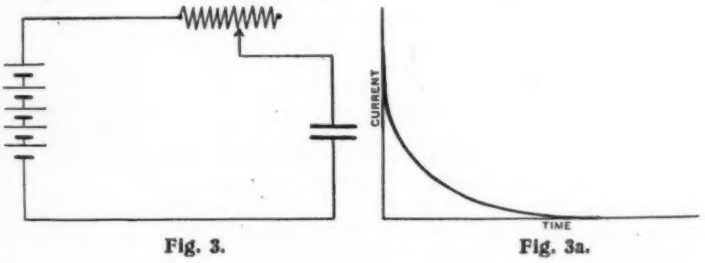


Fig. 3.

Fig. 3a.

So far an effort has been made to show that fluctuations of r about a given point would result in the capacity C receiving a greater charge in the case of fig. 4 and a lesser charge in the case of fig. 5, with a consequent increase or decrease of potential across its

terminals, either case resulting in an increase of potential across R. It is now pointed out that such a condition is cumulative, since so long as r is being varied, C is either gaining more than it loses, or losing more than it gains, until a position of balance is reached when the excess of energy being received is equal to that being dissipated, or *vice versa;* and since the increase in energy received is proportional to the amplitude at which r is varied, then the potential across R may be said to increase as the amplitude of variation of r increases, which is the condition under which "accumulative anode detection" is believed to operate.*

In view of the fact that the presence of capacity across either R or r results materially in producing the same effect, it follows that the presence of capacities across both resistances, as shown in fig. 6, will result in mutual co-operation between the two capacities, and for the purposes of calculation they may be regarded as being in parallel with each other and across one or other of the resistances. Such cumulative action is of a logarithmic character, since for each operative portion of successive cycles the amount of energy received by C is a percentage of the remaining difference. An attempt to show this is made in fig. 4a, although it must not really "by-pass" the high-frequency currents, but acts as a reservoir to supply the surge of current through the reaction coil which would otherwise be missing were the supply available only through a highly resistive or highly reactive feed, the condenser absorbing its necessary charge during the negative half-cycle of the potential applied to the grid of the valve and discharging itself during the positive half-cycle; therefore, the term "by-pass" is a misnomer.

The effect of capacity across the anode resistance of an intermediate valve has already been suggested in the author's article mentioned previously, and it is therefore unnecessary to deal with what is, perhaps, one of the more important functions of this effect. It is sufficient to point the connection and to suggest that it seems more probable that the limitation of the value of resistance permissible in the anode circuit of a low-frequency amplifier for distortionless amplification, although dependent on the presence of local capacities, is due rather to the limitation of the permissible time-constant than to any "by-pass" effect of such capacities. Similarly, the use of resistance-capacity coupling for high-frequency amplification will suffer in the same manner, only to a greater degree, since the limitation of the

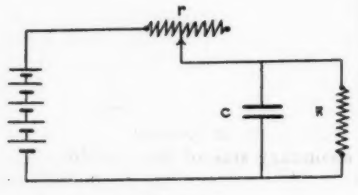


Fig. 4.

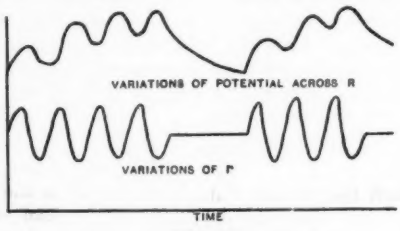


Fig. 4a.

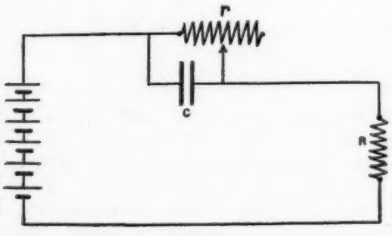


Fig. 5.

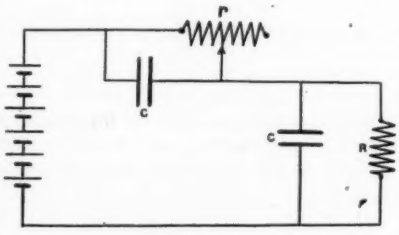


Fig. 6.

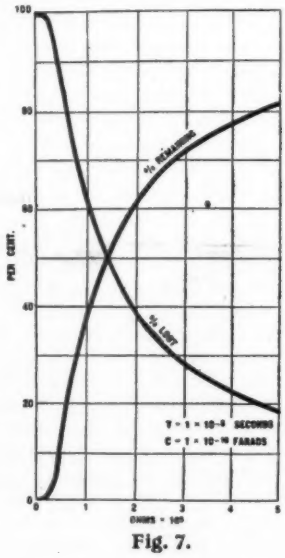


Fig. 7.

be emphasised that graphical representation is based purely on assumption and not on practical data. It should be observed that should the cycle of variation of r be of a non-linear character, *i.e.*, that although the motion by cyclic, the change in resistance on one side of the normal be greater than that on the other side, the effect on the unbalance may be greater if the decrease in r is greater, or less if the decrease in r is less, as in the case of the thermionic valve.

The foregoing remarks may at first appear to be a form of continued repetition of one idea, but it is intended to reiterate the importance of the consideration of such circuits wherever met with, not as a comparatively simple alternating-current problem, but as an extremely intricate one involving the consideration of a fixed and a variable time-constant being in operation during a complete cycle of change. With this object in view, it is now proposed to take certain portions of normal amplifier and other wireless circuits and endeavour to suggest those points wherein this method of consideration in design might be applicable.

It is usual when employing the "detector" valve as a means of obtaining reactive coupling to connect a condenser between the high-potential end of the reaction coil and the filament, in order, as it is usually expressed, to "by-pass" the high-frequency component, which would otherwise be unable to pass either the anode resistance or the primary winding of the low-frequency transformer. It is suggested that this condenser does

* Elec. Rev., December 9th, 1927.

time-constant, to prevent rectification, is of a much lower order.

It should be noted that the coupling condenser (in a resistance-coupled amplifier) forms part of the capacity across the anode and filament of its preceding valve and, although it is in series with the grid-leak and grid-filament capacity of the following valve, the use of condensers of large electrical and mechanical dimensions (with their consequent large capacities to earth, such as paper-dielectric condensers having metal outer cases) is liable to be the cause of unnecessary distortion due to the rectification of the higher order of frequencies, which would more than annul any beneficial effect which might be likely to accrue from the use of such a condenser in preference to one of smaller electrical and mechanical dimensions.

The effect of capacity in parallel with the primary windings of low-frequency transformers, or in parallel with the anode-filaments of their attendant valves, ignoring the conditions of resonance, is not to "by-pass" the higher frequencies, but to create a tendency to build up an opposing potential across the primary windings, thereby tending to rectify the modulations and eliminate such frequencies by slurring them over. This effect is accentuated since the primary winding has considerable inductance, and its reactance therefore increases with the frequency of input. Capacity in parallel with the secondary winding, however, is a normal alternating-current condition.

This case, wherein the effect of inductance is being

considered, is not the same as the general case in question, but is only inserted as an example of the current in the complete circuit not being an alternating one in the true sense of the word, and therefore the usual reactance formulæ should not be employed when considering the effect of capacity under these conditions. This also applies when considering the effect of capacities in parallel with a loud-speaker, coupled directly in the anode circuit of its attendant valve, but not otherwise; it may also be a possible reason for the preference for a tuned-secondary circuit rather than a tuned-primary circuit for high-frequency transformers.

Sufficient examples have been given to point out the application of the idea submitted in this article, although no doubt many others will be apparent. As has been said, the usual impedance and reactance formulæ should not be employed when considering the functions of such circuits, and it therefore seems necessary that some new formula should be evolved to deal with such conditions. Although it has not been within the scope of this article to produce such a formula, it is hoped that the work which is being carried on will eventually result in providing the necessary alternative.

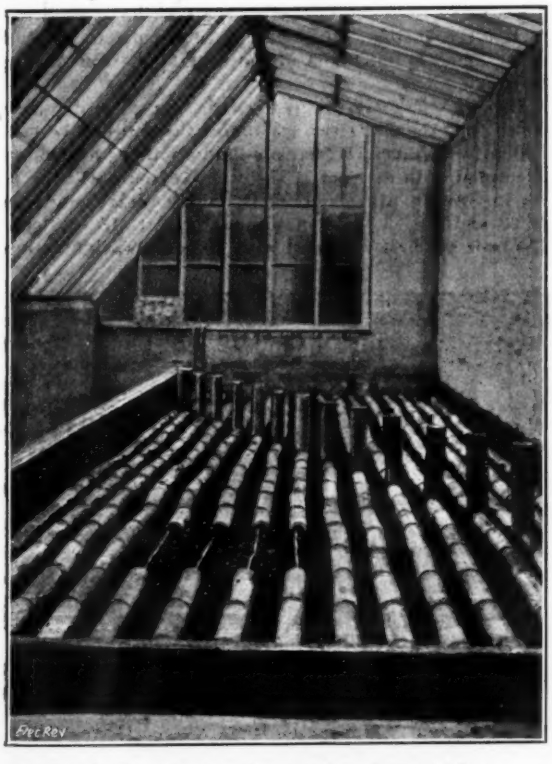
In conclusion, may it be said that this article has been written in the hope of providing a new viewpoint on what appears to be a much overlooked subject. Although the views expressed are mainly those of the author and do not necessarily represent the Air Ministry's views on the subject, it is hoped that they may at least be the means of stimulating thought in this direction.

Electric Heat in the Garden.

Electrical Heating of the Soil is the Latest Development in the Modern Garden.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

THE custom of heating greenhouses and hotbeds by hot-water or manure has hitherto been universal; but, owing to the passing of the horse in favour of mechanical transport and the consequent shortage of good manure close at hand, coupled with the high cost of labour for handling such heavy material,



Preparing the soil; note earthenware pipes and vertical tubes.

Fig. 1.—Electrically-heated Greenhouse.

apart from its erratic behaviour as a heating agent, the method has become not only costly, but also inconvenient.

It was in 1923 that the suggestion of heating the soil by means of electricity was first made in Norway. Mr. G. Jacobson, chief engineer of the municipal works at Aker (near Oslo), was first led to embark upon soil-heating experiments by observing that the grass over a high-voltage cable near his power station far outstripped in appearance the grass growing elsewhere. For about two years Mr. Jacobson experimented in his own garden with electricity from the ordinary lighting circuit (220 volts) transformed down to from 5 to 10 volts. His resistance, connected to the secondary side of the transformer, consisted of lead wire, steel ribbon, &c., but the lack of regulation of the heat and the expense of the installation rendered it commercially impracticable until, when working in collaboration with Mr. H. Olsen, the latter hit upon the idea of using lead-covered cable containing resistance wire, and in 1925 and 1926 the proposition was gradually perfected.

To-day, in Norway alone, approximately two hundred nurseries are making use of this new method, which is also employed extensively in Sweden, and to a certain degree in Germany, Denmark, and Austria. In the neighbourhood of Stockholm last year the central-station load due to this type of hotbed was 500 kW, and this year it is expected that the load will be very greatly increased. Experimental work has also been commenced at Washington (U.S.A.), whilst in this country there are two installations of this type, one at the Cheshunt Horticultural Research Station and the other in the garden of the author at East Grinstead. On every side excellent results are shown: there are records of good crops grown under these conditions during seasons when ordinary methods completely failed. A certain amount of data is, therefore, available upon which these notes are based.

Consumption of Electricity.—In a well constructed frame 0.02 kWh will raise the temperature of one square yard of soil, at a depth of 2 in., one deg. F. On this basis the maximum consumption per square yard is

Table I.—*Current Consumption and Area Heated by 500-watt Cable.*

No. of hours during which current is on.	Watts per sq. yard.	Area heated with 500-watt cable (sq. yds.).
24	60	8.5
22	66	7.5
20	72	7.0
18	81	6.0
16	90	5.5
14	105	4.8
12	120	4.0
10	144	3.5

about 60 watts, as it is usually necessary in the early spring and late autumn to raise the temperature of the soil to 75 deg. F. It is not, of course, necessary to maintain a constant supply of energy, as the soil retains its heat for a very long period; hence arrangements can be made with the supply authorities, who usually have

surplus power during certain hours of the day and night which they are prepared to sell on very attractive terms. The consumption per square yard of soil will then vary with the length of time it is turned on, as shown in Table I.

The heating of the soil in a greenhouse is a more expensive proposition, as a greater volume of air is present (fig. 1); however, excellent results have been obtained in this way with flowers, tomatoes, and cucumbers, and when allowance is made for the saving on the ordinary heating the cost is not prohibitive.

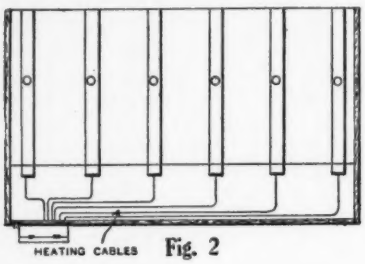


Fig. 2

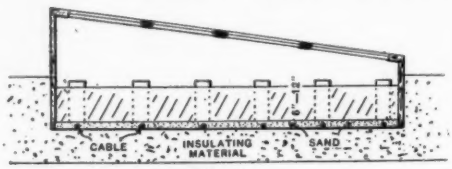


Fig. 4

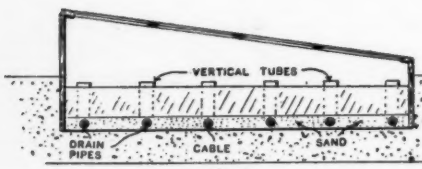


Fig. 3

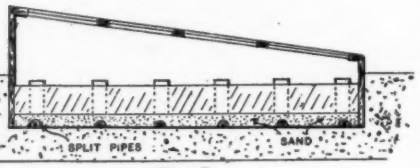


Fig. 5

Figs. 2 to 5.—Standard Swedish Hot-beds.

The Cable.—The heating cable consists of go and return resistance wires mounted on impregnated asbestos cords in the same lead sheath, so as to obviate end-connections, which are usually extremely difficult under gardening conditions. The exterior of the lead sheath is coated with a heavy bitumen paint to prevent oxidisation due to the action of any manure in the ground. The cables are manufactured in standard sizes of 500- and 1,000-watts capacity. The cable is sealed at one end and open for connection at the other; connection boxes containing switches and fuses suitable for outside work are provided. The current consumption is reduced to a bare minimum by the use of thermostats, which are set to operate at temperatures suitable for the plants under treatment. There is, of course, considerable variation in the correct temperatures required for different plants. The introduction of automatic switches enables the energy to be used at those periods during which the power authorities offer advantageous terms.

United States Experiments.—An interesting series of experiments was recently conducted at the State College of Washington. Two hotbeds, one manure and the other electric, were constructed of the same materials and equally exposed to climatic conditions, while the treatment of the growing plants in both frames was identical. By the end of seven weeks, when the plants were hardened off, there was very little to choose between the two lots, both sets being in excellent condition. However, it was noticeable that considerably less labour was required on the electric hotbed; for instance, ten days before the time for transplanting, the electricity was cut off entirely, which simple act converted the hotbed into a cold bed. On the other hand, with the manure bed it was necessary to remove the plants into a cold frame as the manure continued to give off a certain amount of heat; the preliminary preparation of the manure bed also required a great deal of manual labour, as it is absolutely necessary to pack the manure carefully at the sides of the frame. Hence it was found that, whilst there was no appreciable difference in the progress made by the plants during the period of test, yet labour costs had been considerably reduced in the case of the electric hotbed and, further, the necessity for transferring the plants from the manure bed into the cold bed retarded their growth to such an extent that at the end of nine weeks the plants in the electric hotbed were much healthier and stronger.

In this experiment the hotbed frame measured 6 ft. by 3 ft. (18 sq. ft.), and it was heated by two elements, one of 100 watts and the other of 50 watts. A switch was placed in each circuit to enable the operator to have at his command three combinations of heat, *viz.*, 50, 100, and 150 watts, *i.e.*, 2.8, 5.6, and 8.3 watts to a square foot. The consumption during the seven weeks was 63 kWh. The absence of a thermostat in the heating circuit was partly responsible for the high consumption, as full advantage was not taken of the heat of the sun during the day.

Swedish Experiments.—Swedish experiments have shown that the electrical heating of the soil can be carried out on a much larger scale than anything previously attempted with manure. The standard electric beds in use in Sweden are about 92 ft. long and are made up in 25 sections, 3 ft. 8 in. broad by 5 ft. 10 in. long. The beds are first prepared with a groundwork of about 5 in. of gravel and 7 in. of charcoal and breeze; the breeze is, of course, used for isolating the heat. Vertical tubes are placed at intervals in the beds in order to air the soil (figs. 2 to 5). The cable is placed in rough earthenware pipes (figs. 2 and 3) which are laid in a layer of sand (1.25 to 2 in. deep), and the remainder filled in with soil, allowing a depth of from 6 to 12 in.,

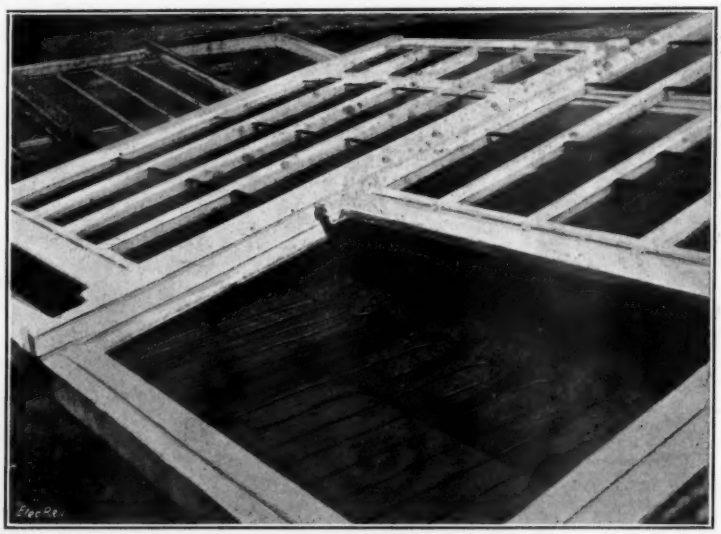


Fig. 6.—Electrically-heated Garden Frame at Greater Felcourt.

varying according to the type and nature of the plants to be grown. The earthenware pipes are used to prevent any damage to the cable by the gardener's spade; fig. 3 shows them in position. Split pipes, as shown in fig. 5, are often used, as they are equally effective. While the pipes act as an additional safeguard against careless workmen, they are not absolutely necessary, and are not used in many installations (figs. 4 and 6), as the sand protects the cable and also helps to distribute the heat in the bed.

The consumption of electricity on twelve frames similar to those described was 1,400 kWh over a period from March 1st to October 15th, and practically the whole of it was used during the night (midnight to 6 a.m.).

Experiments are also being conducted to determine the possibility of electrically heating large areas of land. For this purpose cables are laid at a depth of 1 ft., with a distance between each cable of 16 in. It is claimed that successful results have been obtained in this way, and that all danger from frost is eliminated.

Notes for the Gardener.—Gardening specialists will inevitably turn to this method of germinating their seeds, as it will enable them, in many cases, to hasten germination by control of the temperature without any difficulty. The importance of temperature control is not always appreciated by the amateur: for instance, at 54 deg. F. (12 deg. C.) tomato seeds germinate in twenty days, but by raising the temperature from 54 to 55 deg. F. (12 to 13 deg. C.) the time can be shortened by three and a half days; similarly, the germinating time of leek and onion seeds can be shortened by one day by raising the temperature from 54 to 55 deg. F. (12 to 13 deg. C.), while this time can be further shortened by eight and a half days by raising the temperature to 72 deg. F. (22 deg. C.). Field tests have shown that plants treated in this way are as strong as any grown in the ordinary way.

The first cost of an electric hotbed is little more than that of a manure bed when spread over a period of three years, and when one considers the immense possibilities of its use, *e.g.*, vegetables grown out of season and an abundance of other plants all the year round, merely by controlling the temperature to the degree necessary for the plant to root and grow properly, an even higher expense would be justified. The bed can be operated at any time of the year with no more trouble than merely twitching a switch. The author has found the electrical method far more satisfactory and much less troublesome than the old manure hotbed. Last year he succeeded in growing an excellent crop of melons in his electrically-heated frame, whereas the crop in a control frame with manure only was a failure, as were likewise those of all his neighbours. This year lettuce, melon, and cucumber plants have done well, except that considerable trouble was experienced with slugs. The heated frames served as too good incubators for eggs that got in with fresh earth. The moral is to employ sterilised earth in frames when electric heating is employed.

At an experimental field near Stockholm, strawberries have been raised to maturity in two months by this means. Strawberry plants started in a greenhouse and planted out of doors in electrically-heated soil in April gave a large prolific crop at the end of May, while potatoes planted in April were ready for digging at the beginning of June, *i.e.*, two months before the ordinary crop. Naturally, however, it is by commercial results that this new method must stand or fall. Hence, there is much direct interest attached to a recent statement of a Swedish nurseryman (Mr. Edgar Erikson), who has seven hundred electrically-heated hotbeds covering three-tenths of an acre. He says that, whereas rain last year ruined many vegetable crops, those in such frames were successful; and that he was able to provide fresh vegetables for Stockholm dinner tables well into the Christmas season, an excellent advance on usual practice.

Our Overseas Electrical Markets.

The trend of the Import Trade of Australia, New Zealand, India and South Africa.

WE resume our quarterly survey of the course of trade in Great Britain's chief electrical markets, *viz.*, Australia, New Zealand, India, and South Africa, and show by means of charts the monthly imports of machinery and apparatus into those countries.

Considering the general economic position of Australia, it will be seen that imports of electrical goods are fairly well maintained, although the level of last autumn has not been regained. Great Britain's share in supplying India's requirements of machinery and apparatus keeps up, while South Africa remains a good market for both electrical plant and material, imports being again at the same high level as last summer. New Zealand also is shown to be an active buyer, imports during the March quarter being as high as in any recent quarter.

Australia.

In Australia already a considerable reduction in the adverse balance of trade is apparent owing to the curtailment of imports and the increase in exports of wool. The weather recently has raised hopes of a highly favourable harvest and a good wool clip. Unemployment is still much above normal and engineering supplies have been moving slowly.

If and when it is decided to go ahead with the West Australian settlement scheme, there should be work for the supplier of electrical goods. It involves the establishment of 3,000 farms, and the building of 700 miles of railway, together with extensive road, waterworks and harbour construction. A sum of £10,000,000 is spoken of as the total expenditure, and for preliminary work a £150,000 advance has been approved. An irrigation scheme entailing an expenditure of over £3,000,000 is suggested in Queensland, but this is a matter for the future. The State power station at Morwell is to be increased by the addition of three turbo-generators, while the coal-mining plant will be improved by substituting electrical methods for the present rope haulage. Other improvements will involve the purchase of a number of electric locomotives.

The movement in the Commonwealth in the direction of establishing branch factories behind the tariff wall continues, one of the latest schemes being the establishment of a £1,000,000 plant at Newcastle, N.S.W., for the manufacture of iron and steel pipes.

British electrical manufacturers will await with keen interest the report which the Australian Government has asked the Tariff Board to furnish on the question how far works within the Commonwealth can supply the country's requirements of electrical plant. The supply undertakings complain that the import duties levied on plant are raising the costs of installations and consequently making electricity so dear that extension plans cannot be carried out. There is evidence that local builders of large power plant cannot produce it at an economic price, a fact which is not surprising in view of the great expense of developing the design and manufacture of large turbo-alternators. In this connection the circumstances attending the order placed locally by

the Victorian authorities are quoted. The contract price was £47,885, over £10,000 more than the lowest British tender, including duty. The Electricity Commission admits that it was placed in disregard of sound commercial and economic principles. A reasonable solution of the problem appears to be that indicated on behalf of the Australian General Electric Company, *viz.*, that any manufacturer tendering for the supply of a

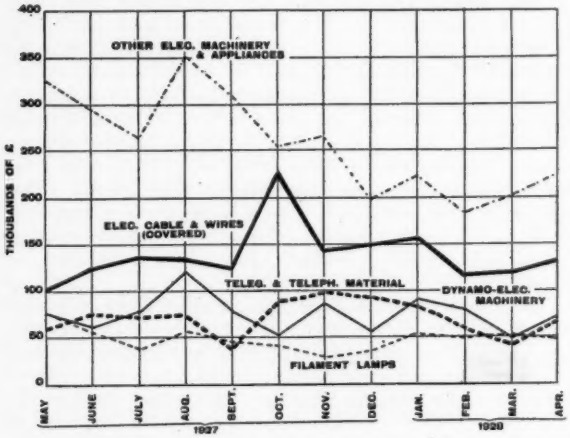


Fig. 1.—Australian Electrical Imports.

turbo-generator, complete with condensing plant, who undertakes to spend, say, 30 per cent. of the selling price on labour and material in Australia, should be allowed to import the balance free of duty, and receive some protection against the machine completely manufactured in the Commonwealth.

New Zealand.

New Zealand trade was affected by the shipping dispute in Australia, but not to any serious extent. The Dominion's staple products, *e.g.*, butter, cheese, frozen beef, mutton and wool, show increased output, and the country's export trade has in consequence been favourably influenced. For the half year its total value was £37,715,000, whereas imports were only £20,915,000 in value. This healthy balance makes the total export surplus for the twelve months £12,000,000. The banking position also shows a great improvement.

It is not expected that the demand for electrical plant will remain at the high level it has attained in recent

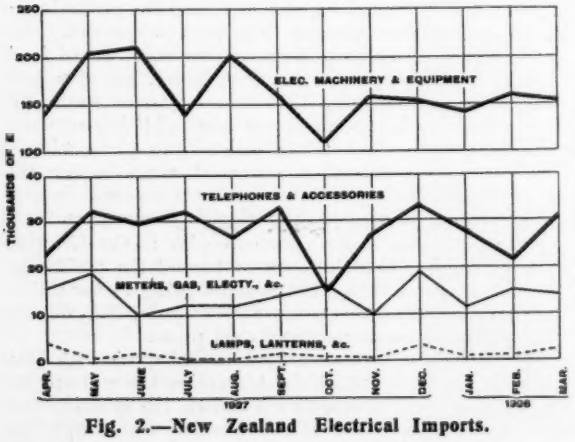


Fig. 2.—New Zealand Electrical Imports.

years, as it is felt that requirements of power-station equipment are satisfied for the time being at any rate. A measure of the demand for electrical goods of the lighter descriptions is furnished by the building activity in the larger towns. At the end of last year this was at a comparatively low level, the total building permits issued for December being only £548,000 in value. In the following month there was an increase to £801,000, while in March the figure was £704,000. The total tonnage of goods carried on the railways during the financial year ended March 31st, 1928, was rather more than during the previous twelve months. The index number of export prices (all groups) during March was 1,746, compared with 1,640 in February, and 1,509 in March, 1927.

It is expected that with the appointment of Mr. J. W. Mawson as Director of Town Planning, the schemes contemplated under the Act passed last year will go ahead.

India.

With the issue recently of the report of the Royal Commission on Agriculture, attention has again been directed to hydro-electric development in India, particularly in its application to cultivation. In addition to the natural reserves of water power available in certain parts, notably in the submontane districts of the Himalayas and in the Western Ghats, including the Nilgiris, it is probable that opportunities exist for obtaining power by utilising falls of a few feet on rivers in the plains, and by the construction of similar falls on canals. With regard to the latter, it is understood that attention is now being paid in new irrigation projects to this source of power, and the report adds that this should certainly not be neglected in view of possible future demands for power both for industrial and agricultural purposes. The possibilities of this source of power have been strikingly illustrated by the success of the hydro-electric scheme carried out by Sir Ganga Ram at Renala in the Lower Bari Doab Canal Colony of the Punjab, where 80,000 acres is irrigated by a 6-ft. fall.

From the agricultural standpoint, electric power has at present two main uses, as a motive power for machinery, including pumps, and as a means of obtaining supplies of synthetic nitrogen from the air. The Commission, however, gives reasons for doubting whether the manufacture in India of synthetic nitrogen from the air is likely to prove economical. Thus, in existing conditions, the immediate openings for electric power for agricultural purposes are confined to pumping schemes. The Commission has been informed that a considerable development of the industrial use of electric power may be expected in Lahore and Amritsar and their immediate neighbourhoods. Such an area as this, it considers, offers the best prospects for testing the agricultural uses to which electric power, surplus to industrial requirements, can be put; and it has no doubt that the Government of the Punjab will see that

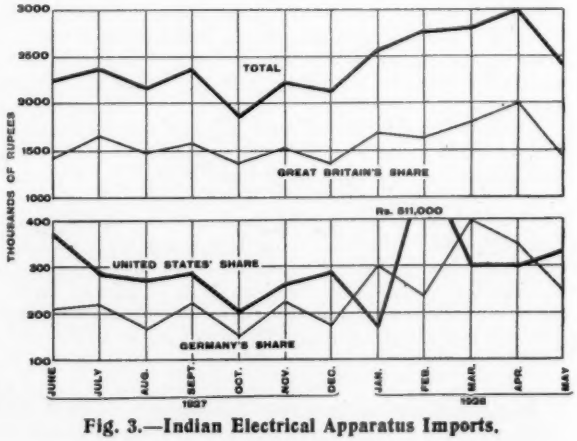


Fig. 3.—Indian Electrical Apparatus Imports.

full advantage is taken of this and of any other opportunity which may present itself.

Whilst the development of its hydro-electric schemes is now a matter for which each province is entirely responsible, it is considered that it would be of great value to the provinces if some central organisation existed from which information with regard to hydro-electric developments in India, as well as in other countries, could be obtained. The Commission there-

fore recommends that the Central Information Bureau which it has proposed should also act as a clearing house of information on hydro-electric matters. The opinion is expressed that expert advice with regard to any particular scheme of development can best be obtained from a firm of consulting engineers rather than an expert permanently at the headquarters of the Government of India.

The general commercial situation has been over-

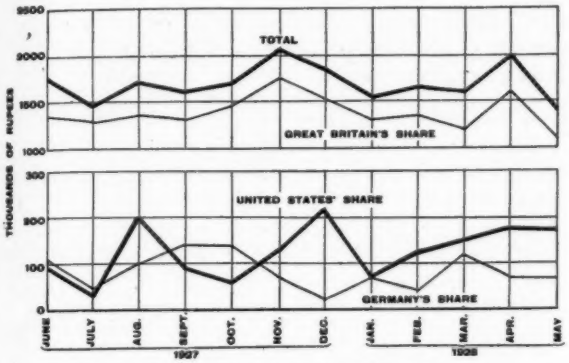


Fig. 4.—Indian Electrical Machinery Imports.

shadowed by labour disputes. The result has been, not only marked hesitation on the part of merchants, but also actual diminution in the purchasing power of the community. Meanwhile the monsoon has been normal, except in the North-West.

South Africa.

In South Africa generally the commercial outlook is considered to be good. Since the drought in the Cape Province broke, business in many lines, *e.g.*, agricultural implements, fencing, building supplies and motor-cars, has improved. In Durban, however, there is rather an over-supply of motor vehicles.

For the first half of 1928 the gold output was £21,535,000 in value, compared with £21,048,000 during the first half of 1927. The maize crop estimate is above that of last season's yield by over 500,000 bags, while there is expected to be an exportable surplus of sugar of 100,000 tons. The Natal cotton crop shows a large increase. Of tobacco, crops have been so bountiful in Rhodesia and elsewhere that growers are urged to reduce their acreage. Wheat and fruit prospects have improved.

The industrial development of the Union will be

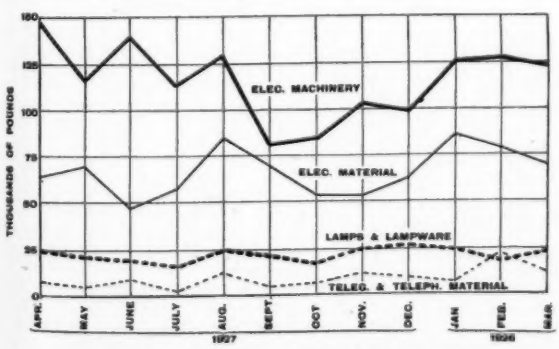


Fig. 5.—South African Electrical Imports.

carried a step further when effect is given to the recommendations of the Board of Trade that a fuel research board and industry for the distillation of oil from domestic coal be set up. During the current financial year over £6,000,000 will be spent on railway work, the bulk of which will consist of new lines. Port Elizabeth is to spend £400,000 on additional power-station plant, £150,000 on new municipal offices, and £25,000 on housing.

Electricity at Tientsin.

The annual report for 1927 of the electricity department of the British Municipal Council.

BOTH financially and technically 1927 was a satisfactory year for the Electricity Department of the British Municipal Council of Tientsin, North China. During the last eight years the aggregate net profit amounted to £85,326, and for 1927 the revenue of £66,548 was £21,488 in excess of the expenditure.

A feature of the annual report, a copy of which has been sent us by Mr A. M. Sillar, M.Inst.C.E., M.I.E.E., M.I.Mech.E., the Council's London consultant, at the request of Mr. R. A. Williams, M.C., B.Sc., A.M.I.E.E., A.M.I.M.E., engineer and manager of the undertaking (which was described in ELEC. REV. of July 8th, 1927) is the very small capital outlay of £18.9 that has been incurred per kW of plant installed, which figure covers the whole undertaking, generating plant, transmission and distribution systems, and even the plant that is hired out, and is less than the cost of the power-house equipment alone in the case of a station in Great Britain; moreover, the cost of the generating plant was £13.8 per kW, which is probably a record.

The station now contains two Howden-G.E.C. 1,250-kW sets, which are used principally for stand-by purposes, and two Metropolitan-Vickers 2,500-kW sets, one of which commenced operation in September, 1927, it having been erected entirely by the Electricity Department's local staff. The five Babcock and Wilcox boilers have a total steaming capacity of 86,000 lb. per hour, and not a single tube has had to be replaced since the station started working; feed water is furnished by a large distillation and de-aeration plant. The coal consumption will not, of course, compare with that of big stations, but it is better than the average of Group F stations at home. In 1927 it was 3.13 lb. per kWh generated (3.99 lb. per kWh sold), an improvement of 0.09 lb. (0.15 lb.) during the year, and the fuel used included that utilised for the distillation of 160,000 gallons of water (sold to ice and mineral-water factories) and for heating the station offices.

The transmission system is overhead and sectionalised into 12 portions, each of which is fed from a sub-station, the capacity of the transformers therein being 3,925 kW. The maximum demand experienced during the year was 2,860 kW (on which day 33,010 kWh were generated), which is an increase of 26 per cent. The energy sold amounted to 6,167,312 kWh, an increase of 30.6 per cent., and the number of consumers increased by 29.2 per cent. to a total of 2,869, whilst the average amount of energy sold per consumer during the year was 2,149 kWh; these figures may be described as remarkable, since the area served by the undertaking is not an industrial one.

Public street lighting increased by 21 per cent., and private lighting (3,068 kW) by 18.1 per cent. The power load grew by 12.3 per cent. to a total of 2,259 kW, and the energy consumed for power purposes increased by 43 per cent. to 1,612,424 kWh.

Progress was made with electric cooking and the capacity of cookers connected aggregated 695 kW, compared with 556 kW in 1926; the showroom stock and appliance demonstrations served a useful purpose, special interest having been taken in small electric refrigerators for household use, with the result that the sales from the showroom increased 20 per cent.; several hundred electrical repairs were carried out in the small workshop attached thereto. In addition to the electric clocks already in use, which are controlled by a master clock on the d.c. installation, a new type was introduced during the year: it is known as the "Telechron," and is suitable for connection to the house-service mains by plug and socket at the domestic a.c. pressure of 220 volts. This type of clock, which does not require to be wound, oiled, or cleaned, and keeps accurate time, is being adopted by many consumers.

A Norwegian Hydro-Electric Extension.

A recent extension to the hydro-electric power plant at Vemork, Norway, for the supply of electricity to the atmospheric nitrogen works of the Rjukanfos Co. of Oslo, consists of a 17,500-h.p., 600-r.p.m. Francis turbine, which brings the capacity of the station up to 182,500 h.p. The new set, like the others, works under a net head of from 918 to 950 ft., and the contract demanded a maximum efficiency of 90 per cent. The new set was put to work early in 1927, the acceptance tests being carried out in May of that year. Under test, the turbine showed a maximum efficiency of 91.4 per cent. at an output of approximately 16,000 h.p. The turbine has now done excellent service for over eighteen months, and has thus given practical proof that when clean water is available, the vertical-shaft high-speed Francis turbine is well able to compete with the Pelton turbine under heads of up to 980 ft. in all cases where high efficiencies at heavy loads are required, the efficiencies at partial loads being of secondary importance.

D

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Factory Lighting Campaign.

Arrangements are well in hand for the Factory and Workshop Lighting Campaign which commences in September and runs for that month and the two succeeding months. Last week representatives of the electrical Press met the General Purposes Committee which is conducting the Campaign and were given some particulars of what had been, and was to be, done. The funds for the Campaign have been subscribed by the Electric Lamp Manufacturers' Association, the Electric Light Fittings Association, the Cable Makers' Association, the Electrical Contractors' Association, and the British Electrical Development Association. The General Purposes Committee, which acts under the auspices of the last-named Association, is composed of representatives of those five bodies, Lt.-Col. W. A. Vignoles, director and secretary of B.E.D.A., being chairman. As we have previously stated, the Campaign will be directed towards the owners and managers of 100,000 factories and workshops. Each of them will receive at regular intervals five communications—not merely requests to better their lighting, but helpful suggestions and data based on thorough investigation. One useful piece of matter will be a copy of the pamphlet compiled by E.L.M.A. recommending illumination intensities for various classes of industry.

Exhaustive inquiries have shown that factory owners are really interested in the subject of good lighting (and this is confirmed by the reports of H.M. Factory Inspectors), and it is mainly lack of knowledge which retards the spread of better lighting in industry. It is therefore considered that the time is ripe for an intensive drive to educate factory owners to the advantages of modern efficient illumination. Stress will be laid on the many advantages which it brings in its train—such as increased production, fewer accidents, reduction of waste, &c. Special attention will be given to the small workshops which collectively account for a very large proportion of industrial activity. It is not expected that a very large percentage of those communicated with will respond, but efforts are being made to reinforce the written word with personal contact; this is where the electrical contractor will play a large part. It has been suggested that contractors when tendering for lighting installations shall quote for the standard intensity recommended by E.L.M.A., or at all events state what intensity the installation as specified in the tender will produce. The organisers, who, as has been seen, represent all the interests principally concerned, are confident that the Campaign will be successful in raising the general standard of factory illumination and thereby bring work to manufacturers of lamps and accessories, and contractors.

The Post Office and Telephone Cable Prices.

In its recently-published second report (Stationery Office, 6d. net) the Select Committee on Estimates states that the total value of stores purchased by the Post Office is at present about £5,000,000 per annum. It was stated in evidence that, in order to give British manufacturers preference, foreign tenders were not invited except when the articles required could not be obtained at a reasonable price in this country, and even then such tenders were not in fact accepted. It was also stated in evidence: (*a*) that, with the exception of two firms, the manufacture of cables was in the hands of a cable "ring," the Telephone Cable Manufacturers' Association, from which the Post Office bought about 80 per cent. of its total requirements, which amounted to £1,000,000 per annum; (*b*) that the prices quoted to the Post Office by the Association were higher than those quoted by the Association to Colonial Governments and to the Irish Free State, the reason stated being the keen competition of foreign manufacturers; (*c*) that the Association refused to allow the Post Office to check its quotations by an examination of its costs; (*d*) that the cables could be obtained from foreign manufacturers at considerably lower prices than those paid to the Association by the Post Office. The Committee, while fully appreciating the importance of encouraging home industries, says that it is not satisfied with the position as disclosed by the evidence, and is of opinion that the Post Office should have a free hand to accept tenders from abroad in cases where it is unable to obtain satisfactory evidence that the prices quoted by British manufacturers are not excessive.

The *Manchester Guardian Commercial* quotes Mr. L. B. Atkinson, director of the Cable Makers' Association, as stating that the Committee's statement is not, as a general statement, true. He refers to the "Profiteering Committee," which, in 1921, reported that it could find no evidence from any source that the Association was acting unreasonably in its prices or otherwise; and he meets the Committee's suggestion that the Post Office should have a free hand to buy its supplies in the cheapest market with a plea for British labour and a comparison with foreign labour conditions.

The F.B.I. Quarterly Forecast.

The "Quarterly Trade Forecast and Business Barometer" of the Federation of British Industries for the third quarter of the current year lays considerable stress on the monetary situation in America, which, it is believed, is largely responsible for the inability of the Bank of England to reduce the Bank Rate during the current year, despite the phenomenal imports of gold. Moreover, it has unsettled commodity markets all over the world, and therefore held up the placing of new orders much in the same way as it has been the controlling factor in the movements of the principal Stock Exchanges of Europe. Until, therefore, the American position is cleared up the general outlook is likely to remain unsettled.

The Rating of Electric Motors.

There appears to be some doubt among rating authorities whether electric motors are to be excluded from rating assessments under the terms of the Rating and Valuation Act. The Leeds branch of the Federation of British Industries has accordingly supported a test appeal against an assessment by the Leeds Assessment Committee which included electric motors. The chairman of the Rating Advisory Committee of the Leeds branch states that, although no definite notification has been received, a ruling has evidently been obtained from a higher authority, for the assessment in question has now been amended to exclude electric motors.

The *Yorkshire Post* says that a panel of referees has been set up to deal with questions arising out of the Ministry of Health Order regarding the rating of machinery, and the first appeal (emanating from Portsmouth) has been referred to one of the appointed arbitrators. The case has reference to the degree to which electric motors are to be regarded as ratable under the Order. Independently of this appeal, the Central Valuation Committee has submitted the question of the rating of electric motors to eminent counsel, whose opinion is that motors, if on the consumer's side of the distribution board or main switch, are, generally speaking, not ratable under the Rating of Machinery Order.

Irish Free State Electrical Contracts.

British firms have been successful in large contracts recently placed by the Irish Free State Electricity Supply Board. The contract for the Greater Dublin h.p. feeder cables was placed with Callender's Cable & Construction Co., Ltd., in conjunction with the South of Ireland Asphalt Co., Ltd., Dublin. Messrs. Ferguson, Pailin, Ltd., of Manchester, were successful in obtaining the contract for the transformer kiosks and switchgear, while the erection of the transformers went to the Asea Electric, Ltd. Twenty-six firms, including British, French, German, Belgian and Swiss, competed for these contracts. In this connection, Dr. T. A. McLaughlin, managing director of the Electricity Supply Board, speaking at a recent meeting, said that in negotiating contracts, various British electrical manufacturers had urged on him the desirability of giving British firms 10 or 15 per cent. preference in price over Continental firms. The British manufacturers pointed out that it was very hard for them to compete with Continental manufacturers, but, said Dr. McLaughlin, the Irish farmers had to meet very strong Continental competition in the English market, and received no preference whatsoever. They had to sell their goods on a quality and price basis alone. However, just as the Irish farmer was improving his position in the English market by better attention to the quality of his products and the marketing of them, so the British electrical manufacturers, by paying closer attention to the Irish market, were capturing the electrical trade against all comers.

New Swiss Company.

Die Metall Verchromung Gesellschaft is the name of a new company which has been formed in Oerlikon to establish a chromium-plating plant.

Agricultural Show Exhibit.

The accompanying illustration shows a part of the exhibit of the Halifax Corporation Electricity Department at the Great Yorkshire Agricultural Show, held at Halifax in July. The stand actually comprised five compartments, each being 10 ft. wide by 20 ft. deep. Two compartments were fitted up with electrical refrigerators; in the centre compartment were shown various types of vacuum cleaners, floor polishers and motors, the ceiling part of this section being fitted up with different types of electric light fittings; and the remaining

The Halifax Corporation Exhibit.

two portions of the stand represented an electrically equipped kitchen, where cooking demonstrations were carried out throughout the day. The back of the stand was arranged for washing and ironing demonstrations, two different types of the apparatus being demonstrated during each of the three days. It is estimated that between 20,000 and 30,000 people passed through the stand on one day alone. A special brochure was prepared dealing with the Department, and distributed as a "souvenir" of the show.

Unemployment.

There was a further increase (35,470) in the number of registered unemployed during the week ended July 23rd. At that date the total was 1,282,900, as compared with 1,247,430 on July 16th, and 1,026,902 on July 25th. 1927.

Municipal Employés and Spare-time Work.

Recently the Barrow Town Council passed a resolution that, with the exception of the carrying out of the work, duties, &c., appertaining thereto, no person in whole-time service or employment under the Corporation shall, without the Council's written permission, engage in any paid employment or occupation whatsoever, or carry on any regular business of any description." The Electricity Committee resolved that applications for permission should be in writing, and should be sent to the Electrical Engineer for submission by him to the Committee. This was approved at the Town Council meeting on July 30th.

A.T.M. Works Visit.

The enterprise of the Bootle Town Council and its desire to keep abreast of modern improvements was exemplified last week, when some 15 members of the Council and officials, including the mayor, chief constable, fire brigade chief, and borough treasurer visited the Strowger Works of the Automatic Telephone Manufacturing Co., Ltd., Liverpool. The primary object of the visit was to inspect the company's Strowger automatic telephones for public and private service; fire alarm equipment, street traffic flashing signals, and "Xcel" electric domestic appliances, which, in the form of cookers, fires, irons, &c., are already in widespread use in Bootle and district. Having witnessed demonstrations of these appliances, the visitors made a tour of both the main factory at Milton Road, and the Victor Works at Broad Green. Before leaving, the party was entertained to tea in the company's well-equipped Club House, Broad Green Hall, an Elizabethan mansion.

New French Company.

La Société Hydro-Electrique de la Mothe-aux-Aulnaies is the name of a new company which has lately been organised in Paris (143, Rue Saint Martin) with a capital of two million francs, to establish a hydro-electric station in the Department of Yonne.

Increased Hungarian Import Duties.

The *Board of Trade Journal* states that under the terms of an agreement modifying the commercial treaties between Austria and Hungary the Hungarian import duties on dynamos, motors, transformers and parts, including those combined with mechanical constructions (excluding vacuum cleaners, floor sweepers, household washing machines and ice chests and their parts) are as follows:—Weighing each 5,000 kg. or more, from 55 to 65 gold kr. per 100 kg.; from 1,000 to less than 5,000 kg., from 75 to 85 gold kr. per 100 kg.; and from 250 to less than 1,000 kg., from 85 to 95 gold kr. per 100 kg.

Irish Free State Electrical Imports.

The Irish Free State Ministry of Industry and Commerce has issued detailed figures of imports during the three months ending with March last, comparing them with the corresponding period of 1927. From these we have compiled the appended table, showing the value of the total imports of electrical machinery and apparatus into the Free State and the amount attributed to the United Kingdom, as country of shipment, but not necessarily of manufacture:—

	Total imports.		U.K. share.	
	Jan.	Mar.	Jan.	Mar.
	£	£	£	£
Electric wires and cables	49,228	41,478	12,545	11,607
Telegraph and telephone instruments and apparatus	2,711	9,095	2,471	7,894
Electric lamps and parts	11,423	11,094	7,897	8,188
Batteries and accumulators	5,817	5,883	5,207	5,535
Radio sets and parts ...	27,848	21,098	27,540	21,156
Other electrical goods and apparatus	22,220	18,864	16,089	15,426
Generators	2,680	4,185	2,498	3,912
Motors	6,227	4,153	3,142	2,872
Other electrical machinery	21,105	25,218	13,746	23,021
Totals	£149,259	£141,068	£91,135	£99,611

It will be seen that while five of the items show an increase, four have decreased, the quarters' imports representing an increase of £8,191, or about 5.8 per cent. Of the imports £91,135, or approximately 61 per cent., came from ports of the United Kingdom, leaving £58,124 for foreign countries, of which £53,333 is credited to Germany.

Tramway Rent Arrears.

The *Financial News* states that the Middlesex County Council, on July 26th, decided to give notice to the Metropolitan Electric Tramways, Ltd., that unless the balance of the rent, £59,156, due on December 31st last, is paid by August 20th, the Council will take steps to recover it. It was explained that the company had been in arrears for many years, and such a notice as the Council now proposed to send had previously had the desired effect.

Egyptian Electrical Imports.

During the first quarter of the current year electrical goods to the value of £E168,517 were imported into Egypt. Wires and cables were by far the largest item, accounting for £E98,549.

An Industrial Switchgear Showroom.

Messrs. Donovan & Co., Birmingham, now have a good display of industrial switch- and fuse-gear manufactured at their Stechford (Birmingham) works at their recently rearranged premises in Cornwall Street. This includes the latest patterns of ironclad switch- and fuse-gear for light- and heavy-duty purposes, and is illustrated herewith. The showroom is admirably lit, and the equipment is adequately spaced so as to provide easy accessibility to all parts. The whole of the apparatus shown is manufactured to comply strictly with Home Office requirements. Another large showroom contains

Messrs. Donovan's Industrial Switchgear Showroom.

a comprehensive display of domestic electrical equipment. On a broad plinth at the base of the walls, which are partly covered by oak panelling, a wide range of the latest models of fires is accommodated, while on the tables there is a representative collection of kettles, toasters, irons, lighting fittings, &c. The ceiling is hung profusely with the latest pendants and hanging lamps, and there is also a good show of floor standards. New wall fittings, giving indirect floor lighting, are shown, and there is also a display of suction cleaners and floor polishers.

Bankruptcy Proceedings.

W. T. Lacey, 10, George Street, Bath, electrical engineer and contractor.—The public examination of this debtor was held recently at the County Court Offices, Bath, when the hearing was formally closed. The statement of affairs disclosed by the debtor showed liabilities of £562, against assets estimated to produce £93. Debtor attributed his failure to loss on a contract and bad trade. It appeared that debtor commenced business on his own account in April, 1922, with a capital of £80, provided by his wife. The business was fairly successful until three years ago, when he lost between £200 and £300 on a contract for the installation of electric light. Debtor became aware of his position about July, 1925. In answer to the Official Receiver, debtor stated that the contract on which he had lost so much money was one amounting to between £1,200 and £1,300. Unexpected difficulties arose, and he found that he had not estimated sufficiently for labour.

Albert Butterworth Gregory, 29, St. Albans Road, Seven Kings, Essex, wireless expert.—The public examination herein was held on August 1st, at the Shire Hall, Chelmsford, when the hearing was adjourned. The debtor's statement of affairs showed liabilities of £429, against assets of £5. In 1925 debtor borrowed £390 from his parents and purchased an electrical and wireless business at Tottenham for £200, forming a limited company, of which he and two others were the directors and shareholders. Debtor put the balance of the money into the business, which was unsuccessful, and in April, 1926, the company was voluntarily wound up; the debtor carried on the business alone until December, 1927, when he gave it up. Judgment was obtained against him for an amount he borrowed, with costs, but as he was unable to satisfy it, a petition was filed.

Ernest William Kirk, trading as the Ace Radio Manufacturing Co., 26, Curzon Street, Derby, formerly wireless apparatus maker.—The application for the discharge of this debtor was heard on August 1st. The assets amounted to £40. The application was granted, subject to the debtor paying £2 a month.

J. A. Davies, electrical contractor, Eureka, Church Street, Blaenau Festiniog.—First meeting held August 9th, at the Official Receiver's Office, St. Peter's Churchyard, The Cross, Chester. Public examination, September 28th, at the Court House, Portmadoc.

J. N. Davenport and L. A. Hackett Davenport, trading as Hackett & Co., electrical engineers and contractors, 36, Spring Gardens and Albert Mills, Manchester. Trustee, Mr. A. Grierson, 21, Spring Gardens, Manchester, released April 26th.

O. C. Lay (Home Wireless Installation Co.), accumulator specialist, 2c and 2d, High Street, Wandsworth.—Receiving order made July 27th, on debtor's own petition.

N. Jawett, electric lamp dealer, 58, Bedford Street, E.1.—First meeting held August 8th. Public examination, October 19th, both at Carey Street, W.C.

Dissolution of Partnership.

H. J. Hayes & Co., electrical engineers, 78, North End, Croydon.—Mr. H. J. Hayes and Mr. J. Voaden have dissolved partnership. Mr. Hayes will attend to debts and continue the business.

Company Liquidations.

Hackett & Co., Ltd., electrical and radio engineers, Southport.—The statutory meeting of creditors was held on July 27th, at Burton-on-Trent. Mr. J. R. Spooner, the liquidator, submitted a statement of affairs which showed ranking liabilities of £1,788 and net assets of £1,249, leaving a deficiency of £539. The assets included a large number of doubtful debts, and it was not possible to say what they would produce. The company was registered in December, 1924, with an issued capital of £1,204, all of which was fully paid. During the first year it traded at a profit, but since then losses had been incurred. The company declared a dividend at the end of the first year's trading, but none of it was taken in cash, the amount being credited to the shareholders. There was some discussion, but no definite resolution was passed. The following are creditors:—

	£		£
Boothroyd, H. T.	26	Magna Cable Co.	26
Gratrix, S., Jr., & Bros., Ltd.	24	Philips Lamps, Ltd. ...	53
General Electric Co., Ltd.	149	Quitman, C.	33
Hickson, L.	31	Rigby, T. J.	51
Hans Renold, Ltd. ...	46	Stearn Electric Co., Ltd.	136
Korting & Mathiesen, Ltd.	71	Smailes, Holtby & Gray	42
Leigh, C.	20	Southport Elec. Dept. ...	25
Midland Electric Lamp Co.	41	Dept.	25
Orton, G., Sons and Spooner, Ltd.	496	Sax, Julius	25
		Traynor, J.	39
		Winder, R. F., Ltd. ...	48

Norman Baynton Co., Ltd., lamp shade manufacturers, 26, Rathbone Place, W.1.—A meeting of creditors was held on July 30th, at the offices of Mr. G. P. Taylor, C.A., 5, John Street, Bedford Row, W.C.1, the liquidator in the voluntary liquidation of the company. A statement of affairs was submitted showing ranking liabilities of £1,487, all due to unsecured creditors. The net assets were £578, leaving a deficiency of £909. The company was incorporated in April, 1926, with a nominal capital of £2,500. The issued capital was £2,409, consisting of 2,259 shares of £1 each and 3,000 shares of 1s. each. The company was formed to take over the business originally carried on by Mr. C. N. Bradnock, the consideration being the issue of 409 shares of £1 each, and 3,000 shares of 1s. each, and the company agreed to take over and liquidate and pay the liabilities, including the bank overdraft. For the period to March 31st, 1927, the company sustained a trading loss of £867, and for the period from April 1st, 1927, to July 16th, 1928, the approximate loss was £1,151. The cause of the failure of the company appeared to be lack of working capital, over-expenditure on capital account, and trading losses sustained. It was decided to confirm the voluntary liquidation of the company, with Mr. Taylor as liquidator.

Jacksons of Croydon, Ltd., automobile and electrical engineers, Croydon, Surrey.—The creditors of the above company were called together recently at the offices of the liquidator, at 8, High Street, Croydon. The statement of affairs submitted showed liabilities of £3,333, made up as follows: Preferential claims, £318; unsecured creditors, £2,524; and bank overdraft, £490. The assets consisted of cash in hand, £4; book debts, £174 (estimated to realise £100); stock valued at £50; plant and machinery, £25; and furniture, fixtures and fittings, £10; showing a deficiency of £3,143. It was stated that the ranking liabilities included cash claims to the extent of £1,939. The liquidator reported that the issued and subscribed capital was £725, all of which was paid for in cash. Accounts had been regularly prepared, and it appeared that in 1925 there was a loss on the trading of £354, whilst in 1926 there was a loss of £595. The company held showrooms at Park Street, Croydon, at a rental of £250 per annum. Shortly prior to the liquidation an execution was levied, and the stock in the showroom was disposed of. The present position was attributed to the loss of an agency, and the failure of manufacturers to deliver within a reasonable time, which led to the cancellation of orders. In addition, the company had also had to face severe competition. No definition resolution was passed, and the voluntary liquidation will therefore be continued with the present liquidator.

Electrical Supplies (Liverpool), Ltd.—Winding up voluntarily.—Mr. R. B. Bailey has resigned from the office of sole liquidator, and Messrs. P. S. Booth, 2, Bixteth Street, Liverpool, and R. B. Bailey, 10, Dale, Liverpool, have been appointed joint liquidators.

Cheddar Electric Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. A. Gates, of Messrs. Christy Bros. and Co., Ltd., Chelmsford. Meeting of creditors was called for August 7th, at the Electricity Works, Winscombe.

Winscombe Electric Light & Power Co., Ltd.—Winding up voluntary. Liquidator, Mr. A. A. Gates, of Messrs. Christy Bros. & Co., Ltd., Chelmsford. A meeting of creditors was called for August 7th, at the Electricity Works, Winscombe.

Century Cables, Ltd.—Particulars of claims by August 31st to the liquidator, Mr. G. Smith, 137, Victoria Street, S.W.

Private Arrangements.

J. E. Dawson, manufacturing radio engineer, High Street, Boston, Lincs.—A meeting of the creditors of the above was held on August 1st. Mr. J. Tait, a creditor for £365 cash advanced, was elected to the chair. Mr. F. Fugill, C.A., of Messrs. Hodgson, Harris & Co., Boston, submitted a statement of affairs which disclosed ranking liabilities of £2,904. Of that amount £2,622 was due to unsecured creditors and £282 to a partly secured creditor. The latter was the bank, its claim being £349, and as security held life policies of the estimated surrender value of £67. In addition, a building society was a creditor for £1,015, and held a charge on property valued at £1,800. The assets were estimated to realise £1,794, less £23 for preferential claims, leaving net assets of £1,770, or a deficiency of £1,134. The assets consisted of book debts, £254; stock, £600; plant and machinery, £100; life insurance policy, £25; motor car, £30; and surplus from fully secured creditors, £785. The debtor started trading in Boston after being demobilised from the Army in 1919. A balance sheet, prepared as at March 31st, 1927, showed that the capital account was in credit. The present position was attributed largely to a severe illness which the debtor had last year, which necessitated his being away from the business for about three months. No offer was submitted, and it was decided to confirm the deed of assignment which had already been executed to Mr. Fugill. The following are among the creditors:—

	£		£
Marconiphone Co., Ltd.	124	Selectors, Ltd.	45
Cooks Wireless Co. ...	174	Langham Radio Co. ...	29
Chloride Electrical Stor-		Accessories Co.	38
Co., Ltd.	81	Hunt, A. H.	52

T. Forshaw, radio dealer, 75, Poulton Street, Kirkham.—A meeting of creditors was held on July 27th, at the offices of Mr. R. O. Griffiths, I.A., Preston, when a statement of affairs was submitted showing liabilities of £547, and net assets of £192, leaving a deficiency of £355. The debtor commenced business in 1925 with a capital of £9 of his own

and £25 borrowed from a relative, and since repaid. In December, 1926, he took other premises, and carried on as a radio and gramophone dealer. The turnover for the last six months was stated to have been about £5 per week, and the rent and rates about £2 per week. It was decided to confirm a deed of assignment already executed in favour of Mr. R. O. Griffiths, while a committee of inspection was also nominated, consisting of the representatives of Messrs. Palmer, Riley & Co., Ltd., Ellis & Mort, Ltd., and Mr. P. S. Booth. The following are creditors:—

	£		£
Ellis & Mort, Ltd. ...	... 57	Raws, G., & Sons, Ltd. ...	73
Palmer, Riley & Co., Ltd.	24	Soley, Horace, & Co., Ltd.	20
Brown, S. G., Ltd. ...	... 41	Brandes, Ltd.	... 48
Baxendale & Co., Ltd. ...	84	Leigh & District Lending Society	... 47
British Thomson-Houston Co., Ltd.	... 20	Electric Lamp Factors, Ltd.	... 41
Edison Swan Electric Co., Ltd.	... 24		

E. M. L. BUDD, radio and electrical engineer, trading as the Essex County Electrical Co., High Road, Woodford Green.—A meeting of creditors was held on July 27th, at the offices of Mr. J. Ames, C.A., 49, Leadenhall Street, E.C. The statement of affairs submitted disclosed liabilities of £1,251 and assets estimated to realise £265, leaving a deficiency of £986. It was reported that the debtor commenced trading on his own account in June, 1926. His father advanced him £250, and had since made further loans, and was now a creditor for £476. During the first year the sales were £1,640, and in the following 12 months they increased to £2,265. In the first period there was a gross profit of £394, and in the second a gross profit of £489. After allowing for wages, however, the trading resulted in a small net loss. An offer was submitted of a composition of 8s. in the £, which was subsequently increased to 10s. in the £, payable as to 4s. in cash, 4s. on September 1st, and the balance of 2s. on March 1st, 1929. This was accepted. The following are creditors:—

	£		£
Falk, Stadelmann & Co., Ltd.	...134	Ames, J.	... 32
Ever-Ready Co., Ltd. ...	57	Hart Accumulator Co., Ltd.	... 25
Mullard Wireless Service Co., Ltd.	... 33	Philips Lamps, Ltd.	... 24
		Gates, F. G.	... 23

New Catalogues and Lists.

August calendar blotters have been received from Messrs. J. G. STATTER & Co., Queen Anne's Chambers, S.W.1; POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2, WARREN BROS. (MIDDLESBROUGH), LTD., 91, Grange Road, Middlesbrough; EBONESTOS INSULATORS, LTD., Rollins Street, Canterbury Road, S.E.15; MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow; and the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1. ARTHUR LING & CO., LTD., 138, Fetter Lane, E.C.4, and S. ROGERS AND CO., LTD., 15, Fitzroy Street, Tottenham Court Road, W.1.

THE WESTON ELECTRICAL INSTRUMENT CO., LTD., 15, Great Saffron Hill, E.C.1.—An illustrated catalogue containing full particulars of the company's voltmeters and other instruments for radio measurements.

MESSRS. ISENTHAL & CO., LTD., Ducon Works, Victoria Road, North Acton, W.3.—Leaflet R.628, describing a new type of tubular sliding rheostat for use with small motors, &c., open or protected. Priced.

THE ROTHERMEL CORPORATION, LTD., 24 and 26, Maddox Street, W.1.—An illustrated pamphlet advertising the "Skil-saw" electrically-driven portable circular saw.

THE BRITISH HOME & OFFICE TELEPHONE CO., LTD., 161A-166, Strand, W.C.2.—Two illustrated folders dealing, respectively, with the company's intercommunication system and the "Extendaphone" telephone arm.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—August price-sheet of electrical materials, accessories and appliances. Illustrated.

MESSRS. MATHER & PLATT, LTD., Park Works, Manchester.—A well-illustrated brochure dealing with electric driving in the textile bleaching, dyeing, printing and finishing trades. A novel feature of the publication is the cover, which consists of an actual piece of fabric printed and finished on the company's electrically-driven textile machinery.

LECTRO-LINX, LTD., 254, Vauxhall Bridge Road, S.W.1.—New season's catalogue of specialities for radio work, &c.

MERSEY CABLE WORKS, LTD., Linacre Lane, Bootle, Liverpool.—Price List No. 13 of "Mersey" rubber insulated cables and flexibles.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—List (No. P.240) of cables supplied for working pressures of 20,000 to 25,000 volts.

A. H. HUNT, LTD., H.A.H. Works, Tunstall Road, Croydon.—Leaflet No. 138B, giving particulars and prices of electrical measuring instruments for wireless, including new double-scale voltmeters at low prices.

Trade Announcements.

Messrs. F. PARKS, LTD., lamp-shade specialists, have appointed Unique Fittings, Ltd., 37, Bridge Street, Bradford, sole agents for Lancashire, Yorkshire and Cheshire.

The TROJAN LAMP CO. has opened a wholesale and retail depôt at 30, Old Town Street, Plymouth.

Mr. H. Moss has removed to 178, Manningham Lane, Bradford. His telephone number (Bradford 2687) remains the same.

Messrs. WM. DAWSON & SONS, LTD., have changed their address to Cannon House, Pilgrim Street, Ludgate Circus, London, E.C.4. (Telephone: Central 5822; telegraph: "Nonnac, Cent, London.)

The Direct West India Cable Co., Ltd., the Halifax and Bermudas Cable Co., Ltd., the Cuba Submarine Telegraph Co., Ltd., and the West India & Panama Telegraph Co., Ltd., announce that they have removed their offices to Electra House, Moorgate, London, E.C.2. (Telegraphic address: Quiescent, Ave, London; telephone: London Wall 3240.)

The ENTERPRISE MFG. CO., LTD., have removed to larger premises at 83-87, Merton Road, Wimbledon, S.W.19. Telephone No.: "Wimbledon 5475."

The Birmingham address of Messrs. W. T. GLOVER & CO., LTD., has been changed to 17, Summer Row. Telephone: "5724 Central."

Messrs. GEO. GREEN are removing on August 11th to:—"Gee Gee" Works, Chapel Road, West Norwood, S.E.27 (telephone: Streatham 8727).

New Belgo-American Company.

Under Belgian and American auspices, a company has been formed at Hautmont with a capital of 10 million francs, and the title La Société Electrotube to carry on works for the electrical production of steel tubes.

Annual Holidays.

The works of Messrs. OLDHAM & SON, LTD., Denton, Manchester, will be closed for the annual holidays from August 11th to 18th, inclusive.

Messrs. B. & F. CARTER & CO., Rochdale, are closing their offices and works (except for urgent matters) from August 17th to August 27th.

United States Electrical Exports.

During May last electrical goods and apparatus to the value of $9,850,961 were exported by the United States. This compared with $9,007,888 in May, 1927. The total for the first five months of the current year is $43,999,313, against $41,599,071 for the corresponding period of 1927. Reverting to the May figures, the greatest rises as compared with 1927, occurred in the following classes: Refrigeration sets (up to 1-ton capacity), from $386,170 to $781,864; unspecified apparatus, from $736,071 to $832,556; motor-driven household devices, from $197,525 to $326,781; electric locomotives, from $35,039 to $368,208; d.c. generators, from $61,513 to $191,990; and flashlight batteries, from $164,645 to $224,397. The principal reductions were in a.c. generators, from $273,445 to $111,955; storage batteries, from $315,272 to $236,515; rectifiers, motor-generators and other convertors, from $233,548 to $102,528; metal-filament lamps, from $166,490 to $97,259; searchlights and projectors, from $115,995 to $35,248; radio receiving-set accessories, from $202,909 to $130,063; and insulated copper wire and cable, from $671,017 to $426,190. Canada, as usual, was the largest purchaser of American electrical goods, taking over a quarter of the exports ($2,521,426). The next in order were Japan $745,952, the United Kingdom $630,877, Argentina $622,541, and Australia $531,328.

Chinese Patents Concession.

As a result of representations made by the Federation of British Industries and other bodies, the Chinese Bureau of Patents has agreed that patent specifications in English may be lodged provided that they are accompanied by a Chinese translation or an abstract in Chinese. In addition, it has been conceded that the English specification shall be considered the principal one for the purposes of registration.

Book Notices.

At a time when the charges for electricity made by supply authorities are engaging considerable public attention, the publication by the London and Home Counties Joint Electricity Authority of a statement of charges made by electricity supply undertakings in the London and Home Counties Electricity District, as at July 1st last, is particularly opportune. The statement is divided into three sections, the first giving the charges for lighting, the second the charges for power, and the third the charges for heating and cooking. The undertakings are grouped in alphabetical order. We understand that although all the supply authorities in the area have received a copy of the statement, the Joint Authority still has a limited number of copies which it is prepared to supply at a charge of 1s. per copy to individuals who are particularly interested. The Authority's address is 5, Millbank, London, S.W.1.

"Principles and Applications of Electrochemistry." By H. J. Creighton. Vol. I, "Principles." Pp. xvi+488; figs. 84. London: Chapman & Hall, Ltd. Price 20s. net.

"Income Tax Up to Date." By H. J. Gully. 20 pp. New and revised edition. London: *Financial News*. Price 9d.

"Report on Economic Conditions in Turkey, May, 1928," by Col. H. Woods, O.B.E., Commercial Secretary at the Constantinople Embassy. (31 pp.) London: Stationery Office. Price 1s. net.

New Argentine Company.

The Cia. Internacional de Radio has been registered in Buenos Aires with a capital of $2,000,000 (Argentine paper). Its objects are to carry on radio-telegraphy, radio-telephony, television, &c.

Argentine Labour Troubles.

The Rosario tramway strike ended last week, after lasting 28 days, and the service was recommenced on August 2nd. The telephone company has announced that it is unable to renew the services at present owing to the condition of the lines and to the fact that the strikers prevent the necessary repairs.

Reduced Polish Import Duties.

Until December 31st, 1928, the duties on unmounted porcelain insulators weighing more than 2 kg. each and mounted electrical insulators upon importation into Poland will be at 20 per cent. of the normal rates. The application of the reduced duty (10 per cent. of normal) to carbon electrodes for certain electrochemical processes is to continue until December 31st.

A French Agricultural Exhibition.

An exhibition of electrical apparatus suitable for agricultural purposes is to be held at Montfort-Amaury from September 13th to 16th next. Particulars may be obtained from the Genie Rural, 39, Rue du General Foy, Paris.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.		Price August 7th.	Fortnight's inc. or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	,,	£52	...
a	Bisulphide of Carbon	,,	...	...
a	Borax	,,	£25	...
a	Copper Sulphate	,,	£25 10s.	...
a	Potash, Chlorate	per lb.	3½d. to 4d.	...
a	,, Perchlorate	,,	5½d.	...
a	Shellac	per cwt.	£18 10s.	...
a	Sulphur, Commercial	,,	£11	...
a	,, Roll	,,	£11	...
a	Soda, Chlorate	per lb.	3d.	...
a	,, Crystals	per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ...	per lb.	3½d.	...
	METALS, &c.			
b	Aluminium, Ingots	per ton.	£95 to £100	...
b	,, Wire	per lb.	1/8 to 1/9	...
b	,, Sheet	,,	1/8 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—			
	Grade I	per ton net.	£193	£2 dec.
	Grade II	,, ,,	£185	£1 dec.
	Grade III	,, ,,	£78	...
c	Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	...
c	,, Tubes (solid drawn)	,,	11¾d. to 1/-	...
c	,, Wire, basis	,,	9½d.	...
c	Copper Tubes (solid drawn) ...	,,	1/1½	...
c	,, Bars (best selected) ...	per ton.	£94	...
c	,, Sheet	,,	£94	...
c	,, Rod	,,	£94	...
d	,, (Electrolytic) Bars ...	,,	£69 5s.	...
d	,, ,, Sheets ...	,,	£143 10s.	...
d	,, ,, Wire Rods	,,	£79 5s.	...
d	,, ,, H.C. Wire	per lb.	9⅛d.	...
f	Ebonite Rod	,,	2/8 to 2/6	...
f	,, Sheet	,,	2/8 to 2/6	...
n	German Silver Wire	,,	2/3	...
h	Gutta-percha, fine	,,	6/8	...
h	India rubber, Para fine	,,	11½d.	½d. inc.
l	Iron Pig (Cleveland No. 3.) ...	per ton.	65/-	...
l	,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g	Lead, English pig	,,	£22 10s.	10s. inc.
g	Mercury	per bot.	£22	20s. to 22s. 6d. inc.
e	Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e	,, ,, medium	,,	4/- to 8/-	...
e	,, ,, large ...	,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings	,,	1/9½	...
p	,, ,, drawn bars & rods	,,	1/8	...
p	,, ,, rolled strip & sheet	,,	1/9½	...
p	,, ,, wire...	,,	1/8½	...
o	Platinum	per oz.	£17 15s.	...
d	Silicium Bronze Wire	per lb.	10½d.	...
r	Steel, Magnet, in bars	,,	7½d.	...
n	Tin, Block (English)	per ton.	£312 to £313	£3 to £4 dec.
n	,, Wire, Nos. 1 to 16	per lb.	3/8	2d. dec.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Lighting and Power Notes.

Australia.—Melbourne.—*Year's Working.*—We have received from Mr. W. H. Alabaster, city electrical engineer, a copy of his report on the working of the electricity undertaking, covering the year ended December 31st last, together with the statement of accounts. The total revenue amounted to £531,648, as compared with £492,057 in 1926, working expenses increased from £295,120 to £313,259, and there was a gross profit of £218,390, as against £196,937. Capital charges amounted to £121,150, and other appropriations totalled £72,239, leaving a net surplus, transferred to the town fund of £25,000. A similar amount was contributed to the fund in the preceding year. The capital expenditure during the year amounted to £153,805, and included £31,052 for buildings, &c., £35,938 for machinery, and £45,932 for mains. The electrical energy generated and purchased increased from 80,012,990 to 87,205,320 kWh, and the sales increased by 6,248,301 to 74,387,042 kWh. The maximum supply demanded rose from 28,000 to 31,200 kW, and the average price obtained per kWh decreased from 1.73d. to 1.72d.

Bangor.—Loans.—The Corporation is applying for sanction to loans of £3,000 for mains and £400 for meters.

Barrow.—Extension of Supply.—The Town Council has approved a recommendation of the Electricity Committee that a supply of electricity be given to Meathop Sanatorium, Cartmel, Lindale, and Grange, at a cost of about £10,000.

Bath.—Year's Working.—The accounts of the city electricity undertaking (engineer: Mr. J. W. Spark) for the year ended March 31st last, show a total revenue of £86,091, as compared with £71,230 in 1926-27. Working expenses decreased from £50,763 to £41,100, leaving a gross profit of £44,991 (£20,467). After payment of loan charges, &c., there was a net surplus of £8,205, as compared with a deficit of £9,460 in the preceding year. The capital expenditure during the year, which included £32,377 for mains and services, amounted to £66,573. The electrical energy sold increased from 6,299,189 to 8,759,087 kWh, and the maximum supply demanded, from 4,400 to 5,440 kW.

Birmingham.—Electrical Progress.—At a recent meeting of the Electric Supply Committee it was reported that the sales of electricity during the June quarter showed an increase of 12.8 per cent. over the corresponding period of 1927, and that an additional 600 consumers had been connected to the mains during the past month. A number of satisfactory agreements for large manufacturing supplies were concluded. A reduction in the charges for supplies of electricity in the Warwickshire areas outside the city was decided upon, amounting to ½d. per kWh off the lighting rates and ¼d. per kWh off the power rates. A scheme of assisted wiring was also approved.

Brighton.—Year's Working.—The report on the working of the Corporation electricity undertaking (engineer: Mr. J. Christie) for the year ended March 31st last, records a total income of £240,493, as compared with £228,992 in the previous year, and working expenses of £148,539, as against £169,182, leaving a gross profit of £91,954 (£59,810). After payment of capital charges there was a net surplus of £31,811, as compared with £1,785 in 1926-27. A sum of £15,100 was contributed to the district rate. The amount spent on capital account during the year was £115,073, and included £21,531 for buildings, £53,164 for machinery and plant, and £25,870 for mains. The sales of electrical energy increased from 23,535,145 to 27,160,785 kWh, and the maximum load from 14,600 to 17,200 kW. The average price obtained per kWh fell from 2.12d. to 1.90d. The two new boilers and 15,625-kW turbo-alternator are in course of erection, and it is hoped that they will be available for the coming winter's load.

Canada. — Hydro-Electric Development. — The large amounts of power available to Winnipeg's civic hydro-electric system were disclosed to the Public Utilities Committee of the City Council by Mr. J. G. Glassco, the manager. The original plans for development of the Slave Falls site on the Winnipeg River were on the basis of 65,000 h.p. Mr. Glassco laid plans before the Committee for an additional 35,000 h.p. He also intimated that the future would see an additional 35,000 h.p. developed from the Pointe du Bois plant, which is now producing 105,000 h.p. With the 70,000 additional h.p. disclosed by Mr. Glassco, the City of Winnipeg will eventually have in the neighbourhood of 240,000 h.p. of hydro-electric power from its two sites on the Winnipeg River. Besides the 105,000 h.p. of installed capacity at the City's Pointe du Bois plant, other installations on the Winnipeg River are the 112,000-h.p. installation of the Manitoba Power Company at Great Falls, which is to be increased to 192,000 h.p. by the installation of two additional units, and the Winnipeg Electric Company's development of 37,800 h.p. on the Pinawa channel. Six of the nine power sites on the Winnipeg river in the Province of Manitoba are still undeveloped. The total power available along this reach of the river is estimated to exceed 500,000 h.p., and the power possibilities have lately been improved through the decision to immediately proceed with the erection of a storage

dam at Lower Ear Falls below Lac Seul, in the Province of Ontario, this control work having been arranged between the Manitoba, Ontario and Dominion Governments.

Cheltenham.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. W. J. Bache) for the year ended March 31st last, record a revenue of £65,213, and working expenses of £38,680, leaving a gross profit of £26,532, and after deducting capital charges there was a net surplus of £7,406. The amount spent on capital account during the year was £10,946, the bulk of which was spent on mains and services. The electrical energy sold amounted to 6,070,521 kWh, as compared with 5,326,434 kWh in the preceding year.

Chester.—YEAR'S WORKING.—The report of the city electrical engineer (Mr. S. E. Britton) on the working of the electricity undertaking for the year ended March 31st last, shows a total revenue of £83,276, and working expenditure of £42,389, leaving a gross profit of £40,887. The figures for the preceding year were:—Income, £74,985; working expenses, £50,586; gross profit, £24,399. After providing for capital charges there was a net surplus of £15,726, as compared with £4,188 in the previous year. The capital expenditure during the year was £29,910, and the total now spent on the undertaking stands at £467,678. The electrical energy sold increased from 6,857,960 to 7,675,768 kWh, and the maximum supply demanded from 4,009 to 4,764 kW.

Colchester.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to borrow £7,686 for the provision of mains and sub-station plant and equipment for the Lexden extensions.

Continental.—SWEDEN.—The new power plant at the Kraangforsen waterfall, on the River Skellefte, belonging to the town of Skellefteaa, has been inaugurated. The plant at present has a capacity of 16,000 h.p., and the cost was kr. 5,000,000.—*Reuter's Trade Service* (Stockholm).

HOLLAND.—The Municipal Council of Leyden has granted the sum of fl. 1,900,000 for extensions to the power station. A turbo-generator and two boilers are to be installed, and a new switch house erected.

Croydon.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. A. C. Cramb) for the year ended March 31st last, shows a total income of £277,702, as compared with £269,557 in 1926-27. Working expenses decreased from £136,353 to £106,072, and other expenditure charged against revenue from £52,142 to £42,992, leaving a gross profit of £128,638 (£81,061). Capital charges absorbed £79,649, and there was a net surplus of £48,989, as compared with £10,230 in the preceding year. The capital expenditure during the year amounted to £89,689, the chief items being £41,611 for machinery and plant and £38,018 for mains, services and meters. The sales of electricity increased from 26,978,351 to 31,914,634 kWh, and the maximum supply demanded from 13,400 to 16,200 kW. The average price obtained per kWh decreased from 2.31d. to 2.0d. The new boiler house was completed during the year by the installation of two further 50,000-lb. boilers.

PRICE REDUCTIONS.—The engineer has submitted a recommendation for reductions in the electricity charges, equivalent to a revenue of £14,000.

Guildford.—ELECTRICITY CHARGES.—The Corporation Electricity Committee has decided upon the following charges in the extended area:—Lighting: First 500 kWh per quarter, 7d. per kWh; for any additional quantity, 4d. per kWh. Heating, cooking, and domestic purposes: 1½d. per kWh. Power: First 500 kWh per quarter, 2½d. per kWh; for any additional quantity, 1¾d. per kWh.

Halifax.—EXTENSION SCHEME DEFERRED.—The Town Council has decided to refer back the proposal of the Electricity Committee to spend £159,028 on extensions of plant at the power station. The chairman of the Committee stated that the extensions were urgently required, but the proposer of the resolution to refer the matter back said it was not yet definitely known whether, under the new scheme, Halifax would have a full station, nor was it known whether Halifax or Huddersfield would be favoured or penalised.

Ilford.—LOAN.—The Town Council has applied for sanction to a loan of £17,095 for electricity purposes.

Irish Free State.—DUBLIN.—The Minister for Local Government has received a communication from the Electricity Supply Board with regard to the expenditure on the city electricity undertaking, and he has given his sanction to the raising of a loan of £200,000 to meet the following extensions:—Trunk feeders, Pigeon House to Fleet Street, £20,000; boiler plant and accessories, £40,000; water main, Liffey tunnel, sub-station extensions, feeder cables, housing schemes, showrooms, and sales, £120,000; and turbine, £20,000.

Kettering.—The report on the working of the Urban District Council's electricity undertaking (engineer: Mr. W. A. Walker) for the year ended March 31st last, shows a total income of £66,525, and working expenditure of £36,091, leaving a gross profit of £30,434, to which was added an unemployment grant of £1,867, making a total of £32,301. Loan charges absorbed £28,820, and there was a net surplus of £3,480. The sales of electricity increased from 6,196,768 to 7,202,836 kWh, and the maximum load from 3,960 to 4,559 kW. The average price obtained per kWh fell from 2.19d. to 2.05d.

Kingston-on-Thames.—NEW PLANT.—Plant estimated to cost £5,283 is to be installed at the electricity works in connection with the proposed supply of electricity to Walton.

Pontefract.—PROTEST AGAINST CHARGES.—The Pontefract Chamber of Commerce has decided to apply to the Ministry of Transport for a compulsory reduction of the maximum charges permitted to the West Riding Electric Tramways Co., Ltd., which has a monopoly of the supply of electricity in the borough. It was asserted that the charges were higher than were justified by the cost of the electricity purchased in bulk from the Yorkshire Electric Power Co., and the expenses of distribution. Figures from the accounts of the company were presented showing that the net profit on the local undertaking was £6,283 last year, compared with £3,573 in 1925.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

SEAHAM HARBOUR.—Lighting: From 7d. to 6d. per kWh.

WIGAN.—Power: First 500 kWh per quarter, 2d. per kWh; next 500 kWh, 1½d.; next 1,000 kWh, 1¼d.; over 2,000 kWh, 1¼d. per kWh.

SKIPTON.—Lighting: A reduction of 1d. per kWh. Public lighting: A reduction of ½d. per kWh.

COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—Lighting, private houses: From 6½d. to 6d. per kWh; business premises, from 6½d. to 6d. per kWh.

Rothbury.—ELECTRICITY SUPPLY.—Residents in the district, objecting to a scheme of the Newcastle-upon-Tyne Electric Supply Co., Ltd., to supply electricity by overhead cables, are interesting themselves in a scheme backed by financial interests in Newcastle for purchasing the existing Gas Co. in Rothbury, establishing a generating station on the company's existing site, and utilising existing wayleaves and pipe tracks, so that all cables will be laid underground. As against the Electric Supply Co.'s proposed charge of 9d. per kWh, it is contended that under this system the cost will be only 4½d. per kWh. The syndicate proposing the scheme is understood to be negotiating with several other areas in the north for embarking on similar undertakings.

Seaham Harbour.—ASSISTED WIRING.—The Urban District Council has adopted an assisted wiring scheme, and a commencement is to be made on the Princess Road housing estate, A loan of £3,000 for this purpose has been applied for.

YEAR'S WORKING.—A net profit of £977 is reported on the Council's electricity undertaking for the year ended March 31st last.

Shenley (Herts.).—INSTITUTION SUPPLY.—The Middlesex County Council has arranged to take electricity in bulk from the North Metropolitan Electric Power Supply Co. for the purpose of supplying the colony and mental hospital at Porter's Park, near Shenley. The company will supply electricity at the following rates:—£5 10s. per kWh of maximum demand per annum, and all electricity consumed at 0.4d. per kWh, with a sliding scale based on cost of coal.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Yorkshire Electric Power Co., authorising it to supply electricity in the urban district of Silsden, and the Lytham-St. Annes Corporation to supply electricity in certain parishes in the rural district of Fylde.

Tunbridge Wells.—NEW ELECTRICITY CHARGES.—The Town Council has fixed the following new scale of charges as from the September meter readings:—Tunbridge Wells and Southborough: lighting, 4½d. per kWh; heating and power, 1d. per kWh; domestic rate, ¾d.; domestic rate where consumer has installed hot-water boilers or electric cookers, ½d. per kWh, plus percentage of ratable value, 12½ per cent., or fixed charge per room, 22s. 6d. and 7s. 6d.; extended shop window lighting, 1d. per kWh. Outer areas: lighting, 5d. per kWh; heating and power, 1½d.; domestic rate, 1d.; other domestic rate, ¾d., plus percentage of ratable value, 15 per cent., or fixed charge per room, 27s. and 9s.; extended shop window lighting, 1½d. per kWh.

Wickham Market (Suffolk).—INAUGURATION OF SUPPLY.—An electricity supply for the district was formally inaugurated by the chairman of the Parish Council on July 27th. The supply is provided by the East Suffolk Electricity Distribution Co., Ltd., which obtains electricity in bulk from Ipswich Corporation. The cables were laid by Messrs. W. T. Henley's Telegraph Works Co., Ltd., and the resident manager is Mr. H. S. Prouse.

Willesden.—YEAR'S WORKING.—The accounts of the Urban District Council's electricity undertaking (engineer: Mr. A. W. Blake) for the year ended March 31st last, show a total income of £191,563, as compared with £177,185 in the preceding year. Working expenses amounted to £125,255, as against £136,302, leaving a gross profit of £66,308 (£40,883), to which was added revenue from other sources, making a total of £67,632. After payment of capital and other charges there was a net surplus of £19,472, as compared with a loss of £2,172 in 1926-27. The capital expenditure during the year amounted to £37,763, the bulk of which was spent on mains

and services. The electricity sold increased from 19,234,655 to 22,018,436 kWh, and the average price obtained per kWh fell from 2.211d. to 2.088d.

Worcester.—Domestic Supply.—The city electrical engineer, Mr. C. M. Shaw, has recommended the Electricity Committee to consider the adoption of a scheme of assisted wiring for the smaller houses, together with the supply on the hire-purchase system of electric cookers and other of the higher-priced types of electrical apparatus and that £2,500 be spent out of the surplus profits on the provision of suitable appliances.

Tramway and Railway Notes.

Birkenhead.—Track Renewal.—The Corporation Tramways Committee is to reconstruct the tramway track in Balls Road, between Slatey Road and Woodchurch Road and the down track in Balls Road East, at a cost of £6,500.

Continental.—Belgium.—A scheme is under consideration for the reconstruction of the local railway between Brussels and Lenneck-St. Quentin to provide a service of electric trains between the many new suburbs which have been formed in recent years between those centres.

Italy.—A return recently issued by the Italian State Railway authorities shows that up to the end of September last year about 720 miles of the State railways, representing a track length of approximately 1,500 miles, had been electrified, the majority of the lines being in the Northern Italy section. At the same date work was in hand on the electrification of a further 285 miles of railway, representing 465 miles of track.

Fleetwood.—New Type of Car.—The first of the Urban District Council's ten new Pullman tramcars for the Blackpool-Fleetwood route recently had a trial trip and was duly licensed. A feature is the air-brake attachment, kept automatically in readiness for any emergency by an independent electric motor, and capable of pulling the car up "dead" within its own length. The brake was tested and was found efficient. The "pantograph" is an attachment over the roof which temporarily dispenses with the overhead trolley, and obviates loss of time or difficulty when reversing. Electric signals replace the bell-cord system of communication. Each car will seat 50 passengers.

Hull.—Track Renewal.—The Corporation Tramways Committee has authorised the renewal of the tramway track in Gelder Street, at a cost of £3,435.

India.—Railway Electrification.—The Bombay correspondent of *The Times* reports that the electrification of the Great Indian Peninsula Railway's main line is progressing well. It was originally hoped to open the electric service from Bombay to Poona on March 31st next year. It now appears probable that the new power house will be ready to give a limited supply of current by the end of January, and the transmission lines are likely to be completed in that month. The opening therefore really depends upon the sub-stations and overhead equipment, as well as on the provision of locomotive power. The sub-stations appear to be the most doubtful factor, but it is hoped that it will be possible to run a limited service from the middle of next April. The electrified line to Igatpuri will be opened a year later, when the whole scheme should be completed.

Liverpool.—Year's Working.—We have received from Mr. P. Priestley, general manager of the Corporation tramway undertaking, a copy of his report, together with the statement of accounts covering the year ended March 31st last. The total revenue amounted to £1,523,900, and working expenditure, including rental of leased lines, was £1,202,377, leaving a gross profit of £321,523. The figures for the preceding year were:—Revenue, £1,436,805; working expenses, £1,178,224; gross profit, £258,582. Interest and sinking fund charges absorbed £99,973, and there was a net profit of £221,550, of which £115,000 was contributed to the city rate and the remainder transferred to reserve, renewal and depreciation fund. The amount spent on capital account during the year was £344,832, and included £64,462 for permanent way, £158,564 for land, buildings and fixtures, and £81,152 for motor-omnibuses. The total now spent on the undertaking stands at £3,585,082. A record number of passengers was carried during the year, *viz.*, 269,587,485, being an increase over the previous year of 21,979,358. The car-miles run increased from 17,495,967 to 19,647,507, but the revenue per car-mile fell from 19.055d. to 18.326d. The Edge Lane works were nearing completion, and since the preparation of the report have been formally inaugurated. These works will enable all building, repairing, &c., of the rolling stock to be placed under one roof instead of being carried out at different establishments. The Great Crosshall Street extension from the junction of Hatton Garden to Byrom Street was opened during the year, and 24 improved-type tramcars were constructed and placed in service.

Railway Electrification in the Midlands.—The *Financial News* reports that one of the biggest post-war electrification undertakings outside London is to be begun at once between London Road, Manchester, and Altrincham, sanction having been given to the scheme by the railway companies concerned and the engineers have the work in hand. Specifications are being prepared and the actual work of electrifying the line will begin in the autumn. Various estimates of the probable expenditure are made, but it seems likely that the cost will be nearly £500,000. The subject of electrification has been under consideration for some time, but the general slump in railway traffic throughout the country has caused many schemes to be held up. The change from steam to electricity over nine miles, although complete in itself, is part of a larger scheme. The ultimate idea is to extend the arm into a loop by electrifying the line through Longsight, Mouldeth Road, East Didsbury, Cheadle and Gatley, and link up with the Cheshire lines running between Cheadle and Northenden, Bagueley and Altrincham, which last place would then be the extremity of the loop.

Telegraph and Telephone Notes.

France.—Telephone Service.—The increasing number of motor accidents in France is leading to a revision of telephone facilities whereby provincial exchanges will remain open to a later hour, and on Sundays and holidays, says the *Evening News*. At present the exchanges serving most of the small villages in France are closed on Sundays and holidays, but the French Minister of Commerce is planning to have them remain open on such days up to 7 p.m. for call boxes and 9 p.m. for private residents to enable people to summon help in the event of a motor accident. Arrangements are also to be made to provide a night service from Paris to the suburbs, no connection being available now after 9 p.m.

Guernsey.—Ship-Shore Telephony.—Intending visitors to Guernsey will be glad to hear that wireless apparatus has been installed at the White Rock to enable communication to be kept up with the mail boats to and from the island. The Guernsey States Telephone Department has arranged a new service, by which subscribers may ring up the exchange at any time and ask to be informed of the first definite news of the mail boats' approximate times of arrival. The new departure will prove a great convenience, especially in time of fog or heavy weather, when the arrival of the boats may be considerably delayed.

International Telephony.—Anglo-Norwegian Service.—The Postmaster-General announces that the Anglo-Norwegian telephone service, hitherto restricted in Norway to calls to and from Oslo, has been extended to the whole of zones 1 and 2, that is, to all Norwegian territory south of latitude 64 degrees 30 mins. The service will be extended to the rest of Norway (zone 3) as soon as technical conditions permit.

Telegraph and Telephone Services.—Finance.—The second report of the Select Committee on Estimates to the House of Commons contains references to the Post Office services. A statement is published in Appendix I comparing the business done by the Post Office in 1913-14 with the years 1924-25, 1925-26, and 1926-27, showing the following financial results after charging interest on capital and allowing for depreciation of plant, buildings, &c.:—

Telegraph Service.—	
Deficit for the year 1913-14	£1,211,742
Deficit for the year 1926-27	1,436,690
Estimated deficit for the year 1927-28 ...	1,519,000
Telephone Service.—	
Surplus for the year 1913-14	239,111
Surplus for the year 1926-27	284,074
Estimated surplus for the year 1927-28 ...	200,000

The telephone service is developing rapidly: the capital expended, which was about £29,600,000 in 1914, had increased to £99,700,000 by 1927. The surplus for 1913-14, after providing for interest and depreciation, was £239,111, and for 1926-27 £284,000, and the estimated surplus for 1927-28 was stated to be £200,000, or one-fifth of 1 per cent. on the capital expended. The Committee notes that according to the statement of the Postmaster-General in the House on June 12th, the figure for 1927-28 is now estimated to be £120,000 only, or less than one-eighth of 1 per cent. on the capital. Of the surplus of £284,000 in 1926-27, £103,802 came from the Continental telephone services. Over 1,000 rural exchanges have been put up in the last five years. A proportion of the rural exchanges is unremunerative, and the estimated total net loss on this class of business is £40,000 a year. The policy on which the telephone service is being administered is to run it as near as possible to cost price; so long as this policy is continued, the Committee considers that caution should be exercised to avoid the small surplus shown by the home telephone service being converted into a loss, and recommends that this point should be carefully kept in view.

In view of the recent issue of the Hardman Lever Report on Inland Telegraphs, the Committee does not comment on the telegraph service.

Telephone capital has been provided by loans, but the necessity of obtaining a vote for postal and telegraph buildings results in the relegation of their commencement into the worst months of the year; if all such buildings could be charged on the loan account, economy would result. The Committee is of the opinion that all capital required by the Post Office should be obtained on a single principle, and it recommends that the same course should be adopted for postal and telegraph capital as for telephone capital.

The Telephone Service.—CALL BOXES.—Sir William Mitchell-Thomson, Postmaster-General, in a written reply to a question in the House of Commons, stated that the number of telephone call boxes in December, 1926, was 21,493, while in March, 1928, they totalled 24,054. The receipts from call offices for the year ended December, 1926, was £881,100, the amount received for the year ended March, 1928, being £953,400.

TORQUAY EXTENSIONS.—An addition to the Strowger automatic network at Torquay and Paignton, South Devon, inaugurated three years ago, was made by the opening on July 28th of a third exchange to serve the populous northern suburb of St. Marychurch. It has a present capacity of 1,000 lines, and provision for ultimate expansion to 2,200; the system is 4-digit, with fourth-wire metering, the first selectors being located at Torquay main exchange. When one St. Marychurch subscriber dials another, the first digit is recorded on the first selector in Torquay main, this level being connected *via* a repeater, also in Torquay main, to the second selectors at St. Marychurch. The apparatus was manufactured and installed for the Post Office by the Automatic Telephone Manufacturing Co., Ltd.

Transoceanic Telegraphy.—FINANCE.—In a written reply to a question in the House of Commons, Sir William Mitchell-Thomson, Postmaster-General, stated that on the basis of current earnings, the gross receipts of the Post Office from the Imperial "beam" wireless services might be put at about £470,000 a year, and the credit balance before charging depreciation or interest on capital, at about £212,000 a year. The corresponding figures for the Imperial cables were about £143,000 and about £3,000. The Pacific Cable Board was not within his sphere of responsibility, but he understood that in the year ended March 31st last the gross receipts of the Pacific cables were £397,730 and the credit balance (before deductions for interest, capital repayment and allocation to reserve) amounted to £129,852.

Radio Notes.

India.—RELAYS.—It is understood that the British Broadcasting Corporation has agreed to co-operate technically with the Indian Broadcasting Company. As a preliminary step it has commenced to relay the London programme from 5SW once a fortnight at a time specially suited to the needs of Indian listeners.

United States.—BROADCAST ADVERTISING.—Realisation of a fact that has been appreciated in this country all along, but which is described in America as "a somewhat startling discovery," striking at the foundations of the present system of broadcasting in America, has been made by the John Wanamaker store, which was the pioneer broadcaster in Philadelphia. "Investigations made by a special inquiry among radio listeners during the past two years," runs a statement by that firm, "have revealed that broadcasting is not helping the store in general, or in an advertising way." The Corporation has accordingly closed down broadcasting station WOO, Philadelphia, which has been "on the air" ever since 1922, and it is extremely unlikely that WOO will ever be heard again, says the *Wireless World*. The opinion appears to be growing that many other broadcasting interests would reach similar conclusions if they carried out investigations. The American public may well hope that the question will be allowed to drop, for practically all their broadcast entertainment is provided by firms seeking advertisement.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—October 2nd. Posts and Telegraph Department. Switchboard cords. (B.X. 4621.)*

Bristol.—August 30th. Board of Guardians. Electrical fittings for six months. Mr. T. S. Lamb, clerk, St. Peter's Hospital.

Dundee.—August 13th. Corporation. Electric lighting installation at Ashludie Sanatorium (Administrative Block). Specifications, &c. (deposit 2 guineas) from City Engineer.

Exeter.—September 1st. Standing Committee for Devon. Supply of electric lamps for three years for use of the police. Forms of tender from the Chief Constable of Devon, The Castle, Exeter.

Forfar.—August 11th. Directors of Forfar Infirmary. Installation of electric lighting in extensions at infirmary. Specifications from Mr. David Watterston, architect, 34, Castle Street, Forfar (deposit £1 1s.).

Harrogate.—August 25th. Electricity Department. Two 2,500-kVA 3-phase transformers, 11,000-V switchgear, and one 30-ton travelling crane. (August 3rd.)

India.—MADRAS.—August 14th. Madras and Southern Mahratta Railway Co., Ltd. A.c. motors and starting pillars, paper cables, terminal and joint boxes, rubber cables. (July 20th.)

Irish Free State.—DUBLIN.—August 14th. Electricity Supply Board. Overhead and underground distribution mains and services for Blackrock, Booterstown, Monkstown, Sandycove, and Dalkey. (July 20th.)

August 15th. House service single-phase a.c. meters. House service combined fixed and variable-charge type prepayment single-phase a.c. meters, three-phase, three- and four-wire power meters. (August 3rd.)

August 22nd. 32 kiosk and 13 pole-type transformer stations with switchgear and transformers. (August 3rd.)

Kendal.—Corporation. One mile 6,600-V cable, with pilot and three miles of l.p. cable. (See this issue.)

Llandudno.—September 4th. Electricity Department. E.h.p. and l.p. cables, cubicles, transformers and unit type feeder pillars. (See this issue.)

Llantarnam.—September 3rd. Urban District Council. H.p. and l.p. switchgear, transformers, and overhead and underground mains. (July 27th.)

London.—METROPOLITAN ASYLUMS BOARD.—August 22nd. Rewiring fire-alarm system at Caterham Mental Hospital. Installation of electric lighting in shore and pier buildings, Long Reach Hospital, Dartford, Kent. (July 20th.)

August 22nd. Installation of wireless equipment at Grove Park Hospital, Lee. (See this issue.)

H.M. OFFICE OF WORKS.—August 16th. Steam boiler and feed pumps, &c., at the Forest Products Research Laboratory, Princes Risborough. (July 27th.)

August 13th. Electric cable and wire. (See this issue.)

ST. PANCRAS.—September 4th. Electricity Department. One 15,000-kW generator, condenser, and auxiliaries for the King's Road generating station. (August 3rd.)

ISLINGTON.—August 14th. Electricity Committee. New lead battery. (August 3rd.)

HACKNEY.—August 29th. Board of Guardians. Installation of telephone and fire alarm system at the Branch Institution and School, Brentwood. (See this issue.)

Manchester. — August 14th. Tramways Committee. Sand-drying plant. Specification and form (deposit £1 1s.) from Mr. H. Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly, Manchester.

August 22nd. Electricity Committee. Electric cooking ranges. (See this issue.)

August 31st. Eight 250-kVA, eight 500-kVA, and two 125-kVA static transformers. (See this issue.)

Hospital Sub-Committee. Electric lighting installation for the Baguley Sanatorium. (See this issue.)

New Zealand.—WELLINGTON.—September 11th. Public Works Department. Two 10-cwt. electric travelling indoor cranes. (A.X. 6545.)*

October 30th. Protective relay system. (B.X. 4573.)*

September 4th. Insulating tape. (B.X. 4572.)*

September 25th. Meter-testing equipment for Lake Coleridge. (B.X. 4570.)*

DUNEDIN.—September 28th. Otago Harbour Board. Two 3-ton electric wharf cranes. (A.X. 6621.)*

Portland.—August 15th. Urban District Council. Mains, transformers, and meters. (July 20th.)

Ripon.—August 14th. Electricity Department. Transformers, e.h.p. and l.p. switchgear and cable connections. (July 20th.)

Rochdale.—August 31st. Electricity Department. 500 electric wash boilers during 12 months. (See this issue.)

Salford.—August 13th. Electricity Department. One 20,000-kW turbo-generator set with condenser and auxiliaries. (July 13th.) Two water-tube boilers, with stokers, fans, motors, preheaters, &c. (July 20th.)
August 11th. Town Council. Re-wiring of portion of Municipal Offices, Regent Road. Specifications from the Medical Officer of Health, 143, Regent Road.

South Africa.—Johannesburg.—September 11th. Rand Water Board. Turbo-generator for the Vaal River scheme. (B.X. 4585).*
August 30th. Town Council. Street-lighting time switches. (B.X. 4584.)* 1,000-kVA and 250-kVA transformers. (B.X. 4618.)* Six 10-kVA induction voltage regulators. (B.X. 4617.)*
August 16th. South African Railways and Harbours. Telegraph line material. (B.X. 4611.)*
Volksrust.—September 11th. Municipal Council. Switchgear, motors, meters, cables, &c. (B.X. 4599.)
October 26th. Electricity Supply Commission of South Africa. Plant and equipment for a hydro-electric power station and outdoor sub-stations. (B.X. 4622.)*
Cape Town.—September 4th. Electricity Department. One 1,000-kW convertor set. (B.X. 4604.)*

Stockport.—Electricity Department. 5,250 yd. cable. (August 3rd.)

Stoke-on-Trent.—September 12th. Electricity Department. Two water-tube boilers (60,000 lb. per hour.) (August 3rd.)

Stretford.—August 16th. Electricity Department. 9,200 yd. 33,000-V cables. (July 27th.)

Swindon. — August 18th. Electricity Department. Storage battery, three turbine-driven boiler feed pumps. (August 3rd.)

Uruguay.—Montevideo.—August 22nd. State Electricity Department. Gasfilled metal-filament lamps. (B.X. 4560.)*
September 10th. 338,000 metres of insulated conductors for outdoor use (Hackethal type). (B.X. 4589.)*
September 3rd. 155,000 metres of r.i. wire for indoor installations. (B.X. 4590.)*
September 17th. 4,500 metres lead-covered cable, with junction and terminal boxes. (B.X. 4608.)*
September 19th. Lead-covered conductors. (B.X. 4607.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Barnstaple.—Town Council. Accepted:—
Cables (£17,403).—W. T. Henley's Telegraph Works Co., Ltd.
Switchgear (£2,090).—Harland Engineering Co., Ltd.
Diesel engine and generators (£3,076).—Mirrlees, Bickerton & Day, Ltd.
Storage battery (£269).—Tudor Accumulator Co., Ltd.

Barrow-in-Furness.—Electricity Committee. Accepted:—
E.h.p. transmission line (£8,415).—Johnson & Phillips, Ltd.
E.h.p. switchgear (£768).—Metropolitan-Vickers Electrical Co., Ltd.

Birkenhead.—Electricity Committee. Accepted:—
Mains and equipment in connection with the bulk supply to the Hoylake and West Kirby U.D.C.—Callender's Cable & Construction Co., Ltd.

Chesterfield.—Electricity Committee. Accepted:—
E.h.p. cable (£3,516).—Macintosh Cable Co., Ltd.
150-kVA transformer (£125).—Brush Electrical Engineering Co., Ltd.
Copper wire (£105).—W. T. Henley's Telegraph Works Co., Ltd.
Tramways Committee. Accepted:—
Overhead equipment for New Whittington trackless trolley vehicle route (£4,288).—British Insulated Cables, Ltd.

Guildford.—Electricity Committee. Accepted:—
Transformers in connection with the outer area extension scheme.

Hackbridge Electric Construction Co., Ltd. (accepted)	£2,097
Crompton-Parkinson, Ltd.	2,271
Ferranti, Ltd.	2,275
Bruce Peebles & Co., Ltd.	2,306
English Electric Co., Ltd.	2,337
Johnson & Phillips, Ltd.	2,348
Brush Electrical Engineering Co., Ltd.	2,355
British Electric Transformer Co., Ltd.	2,483
C. A. Parsons & Co., Ltd.	2,745

Hastings.—Electricity Committee. Recommended:—
3,000-kVA Scott-connected transformer for Earl Street sub-station (£1,300); four 150-kVA transformers (£576).—Ferranti, Ltd.
Switchgear for Earl Street sub-station (£3,066); feeder panel (£165); switchgear for Githa Road sub-station (£207).—Ferguson, Pailin, Ltd.
Reinforced-concrete cooling tank at power station (£2,495).—Peter Lind & Co., Ltd. (In place of previous tender since withdrawn.)

Hull.—Hospital Committee.
Electric lighting installation at Mental Hospital:—

Blackburn, Starling & Co., Ltd.	£11,803
W. O. Honor	11,178
Colston Electrical Co., Ltd.	9,800
Napier & Wheeldon	9,585
J. & S. Farr, Ltd.	9,336
W. Broady & Son	8,984
King & Co., Ltd.	8,955
Miller & Garniss	8,679
City Electrical Co.	7,982
H. Hyde & Co.	7,765
Building & Colliery Supply Co., Ltd.	6,730
A. Shaw & Son. (Accepted.)	6,580
City engineer's estimate	7,650

Tramway Committee. Accepted:—
Tramway points (£378).—Hadfields, Ltd.

Leeds.—Board of Guardians.
House lighting battery.—Edison Swan Electric Co., Ltd.

Stockton-on-Tees.—Corporation. Accepted:—
L.p. cable.—W. T. Glover & Co., Ltd.

Liverpool.—Tramways and Lighting Committee. Accepted:—
Copper bands.—T. Bolton & Sons, Ltd.
Six 1,000-kVA transformers (£2,547).—English Electric Co., Ltd.
H.p. switchgear for 12 months.—Ferguson, Pailin, Ltd.
L.p. switchgear for 12 months.—J. G. Statter & Co., Ltd.

London.—H.M. Office of Works.—Accepted:—
Electric lamps.—Edison Swan Electric Co., Ltd., Metro-Vick Supplies, Ltd., Siemens Electric Lamps and Supplies, Ltd.

Manchester.—Paving Committee. Accepted:—
Electric lighting installation for Tuer Street depôt.—Meta Manufacturing Co., Ltd
Electricity Committee. Accepted:—
Cable.—W T. Glover & Co., Ltd.
Sub-station switchgear for 12 months.—Ferguson, Pailin, Ltd.
Switch pillars—Callender's Cable & Construction Co., Ltd.
Electrically-operated coal wagon tipper for Barton power station.—Babcock & Wilcox, Ltd.
Tramways Committee. Accepted:—
Cast-iron bases and finials for tramway poles.—J. Needham & Sons, Ltd.
Tramway rail (copper) bonds.—T. Bolton & Sons, Ltd.

Newry (Co. Down).—Urban Council.
Heavy-oil engine (£4,440).—General Electric Co., Ltd.
Main switchboard (£614).—Metropolitan-Vickers Electrical Co., Ltd.
Travelling crane (£151).—Herbert Morris, Ltd.
Underground and overhead mains and services (£7,754).—Irish Electrical Construction Co.

Northampton.—Town Council. Accepted:—
Refuse destructor (£11,399).—Heenan & Froude, Ltd.

Oldham.—Electricity Committee. Accepted:—
Cable.—Union Cable Co., Ltd.
Stoneware conduits.—Doulton & Co., Ltd., and Albion Clay Co., Ltd.

St. Neots.—Board of Guardians. Accepted:—
Installing electric lighting at the Institution (£160).—Beds., Cambs. and Hunts. Electricity Co., Ltd.

Stone (Staffs.).—Urban Council. Accepted:—
H.p. underground cables (£2,326); l.p. overhead cables (£3,945); and l.p. underground cable (£4,930).—John Collier & Co., Ltd.

York.—Electricity Committee. Recommended:—
Feed-water tank (£155).—W. Dove & Sons, Ltd.

Notes.

Overhead Lines Association.

On October 10th, 1928, the Overhead Lines Association will hold its first conversazione (with overhead-line exhibits), also dancing, &c., at the Wellington Rooms, 105, Victoria Street, London, S.W.1. Electrical men and their ladies are requested to keep this date free, and arrangements are being made for a limited number of guests. Tickets, half a guinea each, may be obtained from the hon. secretary, Mr. Theodore Stevens, 50, Lincoln's Inn Fields, London, W.C.2.

Refuse Disposal Plant at Perth.

A new refuse disposal plant installed by Messrs. Petrie and McNaught, Rochdale, for the Perth Corporation was inaugurated on August 1st. The cost of the plant was £7,000.

Appointments Vacant.

Assistant borough electrical engineer (£350), installation superintendent (£200), and mains assistant (£200) for the Guildford Corporation Electricity Department. Draughtsman (Grade III) (66s. 2d. to 82s.) for the Royal Aircraft Establish-

ment, South Farnborough. Assistant civil engineer (£500) for the Electrical Department of the Government of Ceylon. Foremen (£400) for the Posts and Telegraphs Department of the Government of Nigeria. Telephone engineer for Hong Kong for the Oriental Telephone and Electric Co., Ltd. (See our advertisement pages to-day.)

B.E.S.A. Publication.

The British Engineering Standards Association has just issued a new Specification (No. 317-1928) for "Hand-shield and side-entry pattern three-pin wall plugs and sockets (two-pin and earth type) for domestic purposes." The I.E.E. Wiring Regulation No. 96B requires that "if the conditions are such that a person touching any metal liable to become alive should the insulation become defective is liable to be simultaneously making contact with earth, such metal shall be earthed." The specification enables this regulation to be complied with by the provision of a range of standard sizes of three-pin plugs and sockets of such design and robustness as to conform to the best practice in modern wiring installations. The specification is very similar to B.S.S. No. 73-1927, which deals with two-pin plugs and sockets. The principal features are the fixing of dimensions to secure interchangeability and the fixing of such other dimensions as are necessary in order to secure a reasonable degree of soundness in design and construction. Certain tests are prescribed, such as that for current-breaking capacity, and the materials to be employed in the manufacture of the plugs and sockets are specified. Finally, details are given regarding the dimensions of the gauges to be used by the manufacturer to check the interchangeability of the parts. This new publication may be obtained from the Publications Department, B.E.S.A., 28, Victoria Street, S.W.1. Price 2s. 2d. post free.

Fatality.

The Birmingham City Coroner (Dr. Davison) held an inquest last week on the body of Rupert Frank Woodland (23), electrician, of 111, Palace Road, Small Heath, and a verdict of "accidental death" was recorded. It was stated that the deceased was in the employ of Mr. A. J. Ayres, electrical engineer, and was engaged at a bakery at Yardley, where electrical plant was being installed in place of a gas engine. Woodland, assisted by a youth, was dismantling some temporary cables, and it was necessary to pass them over a revolving shaft. Woodland was caught in the shaft, with the result that three coils of cable became wound round his neck, death ensuing from asphyxia and shock.

A Turbo-electric Liner.

The new P. and O. turbo-electric liner *Viceroy of India*, which is intended for the mail service between Tilbury and Bombay, will be the last word in marine engineering. Great hopes of her are entertained by the advocates of the steamer as against the motor-boat. Her construction is being hurried forward at Stephen's Yard on the Clyde, and she is to be ready for service in time for the Indian rush next year, says the *Daily Mail*. She will have a gross tonnage of 19,000, so that she will be one of the biggest ships on the regular Bombay run, but it is her machinery that interests everybody. The electricity which will actually drive the screws at their most effective speed will be generated by turbines and her oil-burning boilers will work at a pressure of 375 lb. to the square inch, superheated to 650 degrees Fahrenheit. The conditions of the Indian mail service, with its very varying weather conditions, make it necessary to maintain a maximum efficiency over a big range of horse power, and it is anticipated that she will work most economically at anything from 11,000 to 17,000 shaft-horse-power.

A Diesel-electric Locomotive.

After experiments extending over several years, Messrs. Burmeister and Wain have perfected a new type of electric-Diesel locomotive. It combines the advantages of the Diesel locomotive and the electric locomotive, while it is cheap to produce and to run, says a *Daily Telegraph* message from Copenhagen.

Beet-Sugar Factory Equipment.

With reference to the article on "A Beet-Sugar Factory Electrical Installation" in our issue of July 27th, we learn that the motors and switchgear employed in connection with the electrically-driven centrifuges, fig. 9, were manufactured by the Macfarlane Engineering Co., Ltd. The motors are of the two-speed, pole-changing, high-torque type, with a single stator winding, and the controllers are oil-immersed and have quick-make-and-break operation for each speed position.

Atmospheric Pollution.

The Department of Scientific and Industrial Research has just issued its 13th report (H.M. Stationery Office, price 6s. 6d. net) on observations in the year ended March 31st, 1927. The deposits of impurity at 80 different stations in the United Kingdom are considered, and a classification is made according to standards of increasing quantity of deposit denoted by the letters A to D in order of quantity of pollution. It is shown that from 1914 to 1927 the number of stations ranking as A and B increased from 54 per cent. of the total in 1914-15 to 87 per cent. in 1926-27, while stations ranging as D show little improvement, the percentage at the beginning and end of the period being 4. Tables are given setting out the results from different aspects; for example, in Table 1 the highest and lowest deposits for the year are given, and it is shown that the tar deposit during the current year was highest at Burnley, the lowest being at Southport (Hesketh Park). Carbonaceous or sooty matter made its highest deposit at Newcastle-on-Tyne, the lowest being at Rothamsted. The highest deposit of sulphates was at Burnley, the lowest at Southport (Hesketh Park). Table 5 shows the relation of the different components to the total pollution in London, Newcastle-on-Tyne, Malvern and Leeds in summer and winter. It shows a wide variation in the composition of the deposits. For example, in Newcastle-on-Tyne the sooty matter formed from 20.6 to 43.6 per cent. of the total, while at Malvern it formed only 3.3 to 8.6 per cent. The deposit of sulphates at Newcastle-on-Tyne was from 5.9 to 12.8 per cent. of the total, while at Malvern it formed 21.9 to 35 per cent. The relation of sulphur to total deposit is discussed, and the effect of the increasing use of gas, showing that this accounts for some at least of the reduction in sulphates deposited during recent years. A table setting out the annual deposit in London and Glasgow from 1914 to 1927 brings out the gradual reduction of impurity during those years, and also the fact that in the same locality sulphate deposit diminishes more than in proportion to the total deposit. Section 2 deals with the suspended smoky matter in the air and its hourly variation, and a curve shows the improvement due to the coal stoppage of 1926 at Stoke-on-Trent; in London there was no appreciable effect. In section 3 dust counter observations are given from America, Melbourne and Stockholm. The obstruction of ultra-violet radiation by smoke is brought out by a curve which indicates that nearly the whole of the ultra-violet rays are cut off by a comparatively small amount of smoke in the air.

A Sensitive Light Recorder.

A daylight recorder so sensitive that it is claimed to accurately record light intensities between starlight and direct sunlight, a range of more than a million foot-candles or lumens, has been developed in the research laboratory of the General Electric Company of America by Dr. L. R. Koller. It consists of a photo-electric cell and a recording meter, operated by three dry cells and one small battery contained in a box one foot square. Any variation in the intensity of daylight acts on the cell, which in turn causes a variation in the movements of the recording needle in the meter; as the needle fluctuates, a roll of paper is slowly passed beneath the point, making a permanent record, and the markings can be easily interpreted into light intensities either at the time or later with the aid of a chart prepared by Dr. Koller. The photo-electric cell is a gasfilled bulb, 7 inches in diameter, coated on the inside with a very thin layer of caesium, a metal extremely sensitive to light; this layer of caesium "must be just one atom deep."

Revised L.C.C. Theatre Regulations.

The L.C.C. Theatres and Music Halls Committee has now prepared its revised rules and regulations in respect of places of entertainment. As regards the electrical section the only matters of importance to which it appears necessary to call attention are the incorporation of the regulations of the Institution of Electrical Engineers and the omission of the "arbitration" clause included in the existing electrical regulations. Provision has been made so that any reference to the I.E.E. Regulations shall include such amendments of those rules as may be made from time to time. In the event of a further edition of the Institution's Regulations being issued it will then be only necessary to make slight consequential amendments of the Council's regulations and rules. The arbitration clause referred to was inserted in 1906 as the result of conferences with the technical representatives of the two theatrical associations and provided a method for the settlement of disputes between the Council and licensees as to the necessity of any works required. As the Council is the responsible authority for making and enforcing the regulations and has no power to divest itself of its responsibilities, the Committee suggests that the clause should be omitted from the regulations.

Regenerative Braking.

The trial electric locomotive supplied by the Oerlikon Company to the P.L.M. Railway was subjected, a little time ago, to regenerative braking tests on the electrified section of the system between Culoz and Modane, with a view to ascertaining whether, under these conditions, the operation of the locomotive was affected in any way by sudden fluctuations in pressure, such as are encountered during service. The trials were carried out with a trailing load of 500 tons (25 trucks), the pressure at the contact line being lowered or raised by about 500 volts every 20 or 30 seconds. The train was, in each case, accelerated down the incline, after which the speed was gradually reduced by electric braking. Throughout the tests braking took place without any noticeable jerks and without disturbance in the motor. The same arrangement for regenerative braking has been adopted on the electric locomotives for the Spanish Northern Railway, which are to be put into service shortly.

Testing Swiss Measuring Instruments.

A new organisation has recently been formed at Wetzikon by a number of Swiss electrical supply undertakings with the title "Die Eich Genossenschaft für Elektricitätswerk und Elektricitätsverwaltungen" to establish a joint standards bureau for the testing and calibration of electricity meters and other electrical measuring instruments.

I.E.E. Scottish Golf Competition.

It was originally anticipated that the preliminary stages of the proposed annual golf competition in aid of the Benevolent Fund would have been completed by the end of May. As, however, many members had not had an opportunity of entering the competition owing to pressure of business, and the fact that other important functions intervened, it was considered advisable to forgo the preliminary stages, and the Committee has now decided to hold a one-day competition on September 11th. The competition will be played over East Renfrewshire golf course, starting at 2 p.m. The winning players of those who have already sent in returns will play in this competition, which is still open to members of all classes.

Handwriting Taught Electrically.

Addressing the Summer School of the British Social Hygiene Council at Cambridge recently, Prof. A. E. Heath, Professor of Philosophy at University College, Swansea, dealt with electrical apparatus which had been used as an experiment to teach a boy to write. He once had a pupil, he said, who was particularly bright in conversation, but absolutely hopeless at school work. They found that the difficulty simply was that he could not write; he held his pen so tightly and pushed so hard that he was tired out almost at the end of a line. To cure that the boy was given special lessons with an electrical device, using a steel pen, so that he got a shock on the back of the neck every time he pressed too hard. The boy had to form letters between two lines on cardboard. The electrical connection was so constructed that when the steel pen touched the line there was a buzzing sound, and when it went over too far, a bell rang. Thus the boy was able to develop muscular control and form the letters easily.

According to *The Times*, in a statement after the lecture, Prof. Heath said that the experiment took place at a Hampshire school. In this particular case it was successful. The boy afterwards went to Cambridge and did very well.

Electric Haulage on the Rhone Canal.

A scheme for the adoption of a system of electric haulage on the Rhone canal which connects up with the River Rhine is under consideration.

Sydney Bribery Charges.

The London daily papers publish dispatches from Sydney stating that when Judge Thompson opened the Royal Commission of Inquiry into the coal contracts evidence was to be called regarding the payment of bribes to Mr. Richard Woof, the power station superintendent, to Mr. Silas Maling, and to several ex-aldermen. The inquiry was adjourned until August 13th. One of the Press reports states that Maling has disappeared. He had been released on bail pending an appeal against his sentence of imprisonment and fine.

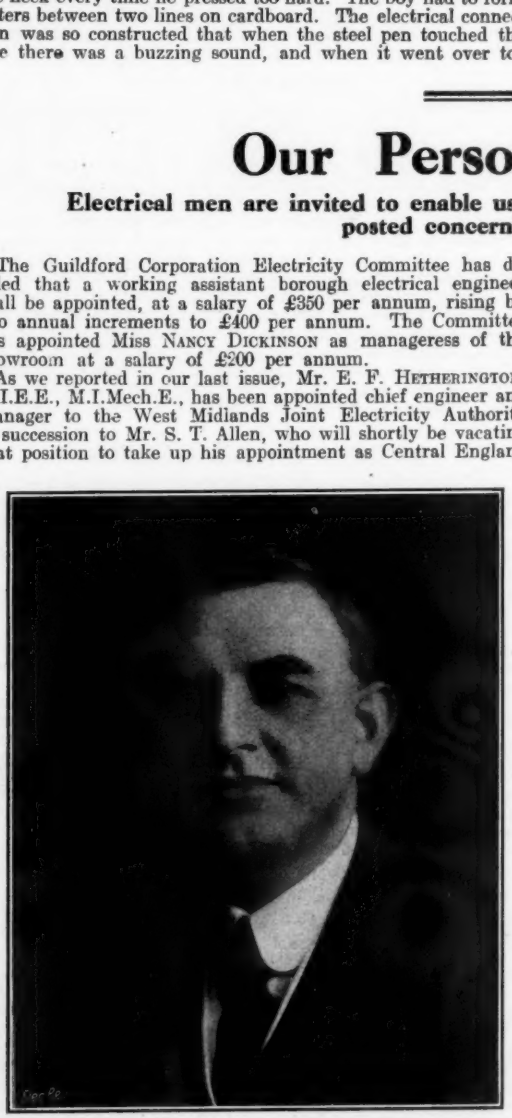
According to the Melbourne *Argus*, at a special meeting of the Sydney Civic Commissioners it was decided to dismiss Mr. S. Y. Maling, formerly deputy-general manager of the Electricity Department, from the service of the City Council. The Commissioners declined to accept his resignation, which was tendered soon after Mr. Maling's return from New Zealand.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The Guildford Corporation Electricity Committee has decided that a working assistant borough electrical engineer shall be appointed, at a salary of £350 per annum, rising by two annual increments to £400 per annum. The Committee has appointed Miss NANCY DICKINSON as manageress of the showroom at a salary of £200 per annum.

As we reported in our last issue, Mr. E. F. HETHERINGTON, M.I.E.E., M.I.Mech.E., has been appointed chief engineer and manager to the West Midlands Joint Electricity Authority in succession to Mr. S. T. Allen, who will shortly be vacating that position to take up his appointment as Central England

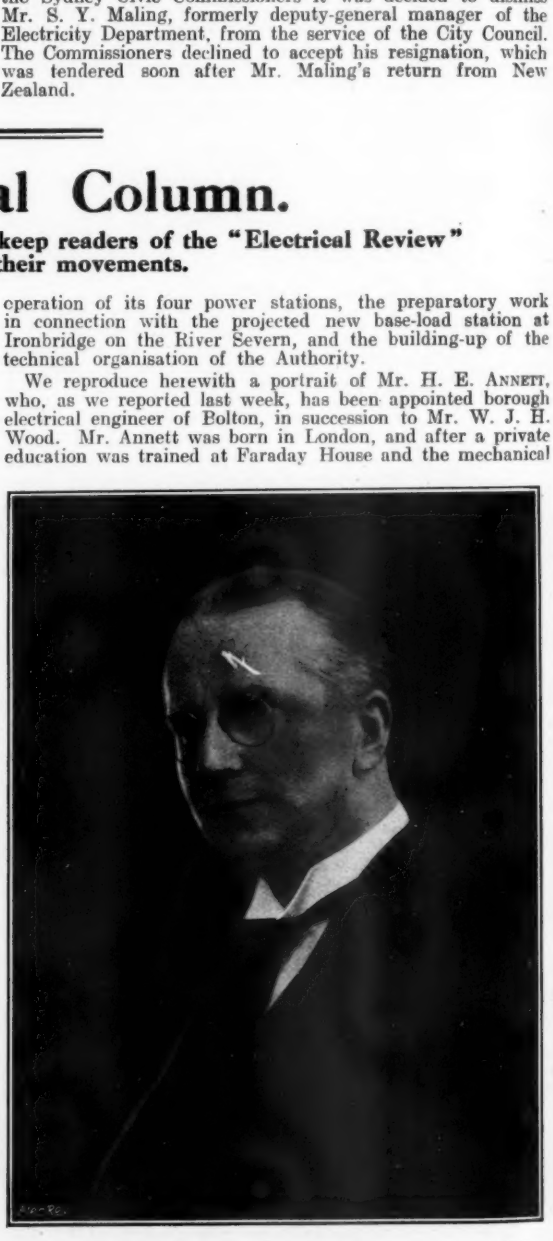


Mr. E. F. Hetherington, M.I.E.E.

Who has been appointed Chief Engineer to the West Midlands J.E.A.

Engineer under the Central Electricity Board. Mr. Hetherington, who had previously been with the North Metropolitan Electric Power Supply Company for over twenty years, was appointed early last year by the West Midlands Joint Authority as senior technical and engineering assistant, in which capacity he has taken an important part in the development of the Authority's scheme of extension, inter-connection, and joint operation of its four power stations, the preparatory work in connection with the projected new base-load station at Ironbridge on the River Severn, and the building-up of the technical organisation of the Authority.

We reproduce herewith a portrait of Mr. H. E. ANNETT, who, as we reported last week, has been appointed borough electrical engineer of Bolton, in succession to Mr. W. J. H. Wood. Mr. Annett was born in London, and after a private education was trained at Faraday House and the mechanical



Kay & Foley [*Bolton*

Mr. H. E. Annett, M.I.E.E.

The new Borough Electrical Engineer of Bolton.

engineering works of Messrs. Plenty & Sons. He subsequently held an appointment in the Blackpool Corporation Electricity and Tramways Department. In 1914 he was appointed resident engineer at the Bolton Corporation's power

station, and has had charge of the Electricity Department since Mr. Wood's departure 12 months ago. Mr. Annett is a member of the Institution of Electrical Engineers and of the Engineers' Committee of the South-East Lancashire Electricity Advisory Board.

As a result of the re-organisation of the Croydon Corporation tramway, Mr. G. D. MORGAN, A.C.I.S., chief clerk of the Department, will be responsible for the commercial side of the undertaking as from October 1st, in consideration of which his salary has been advanced £50 per annum.

The suggestion that the salary of the electrical engineer, Mr. E. G. OKELL, should be stabilised at £900 per annum, rising by two annual increments to £1,000 a year, came before the Plymouth Town Council last week. The chairman of the Electricity Committee, Alderman Miller, in an appreciative reference to Mr. Okell's services over a period of 28 years, strongly recommended the adoption of the recommendation. The matter was, however, referred back to the Committee with instructions to stabilise Mr. Okell's salary at £900 a year as a compromise.

Mr. C. H. SMITH, who has been in the service of the Liverpool Corporation Electricity Supply Department for 42 years, entered upon his retirement last week, and at a staff gathering the city electrical engineer presented him with a wireless receiving set. Mr. Smith was secretary to the city electrical engineer, and he is being succeeded by Mr. A. C. HANSEN.

Mr. J. F. COLQUHOUN, public lighting engineer to the Sheffield Corporation, and president of the Association of Public Lighting Engineers, has been granted permission by the Lighting Sub-Committee to take two weeks' leave of absence to act as British delegate to the International Commission on Illumination in Toronto and New York next month.

Sir ALEXANDER MACKENZIE has resigned from the presidency of the Brazilian Traction, Light & Power Co., Ltd., on account of ill-health. The board recommends that his place shall be taken by Mr. MILLER LASH, K.C.

Mr. G. C. USHER, general manager and director of International Combustion, Ltd., sailed on July 28th for an extensive tour of the United States, and will be away from England until September 16th.

The Birkenhead Corporation Tramways Department has accepted the resignation of Mr. J. DUDLESTON, the traffic superintendent, and granted him superannuation allowance. He is succeeded by Mr. J. N. BISSELL.

The Oldham Corporation Electricity Committee recommends the raising of the salary of Mr. F. L. OGDEN, borough electrical engineer, from £900 to £1,100 per annum.

The Council of the City and Guilds of London Institute has conferred the Fellowship of the Institute (F.C.G.I.) upon the following: Messrs. A. B. BUCKLEY, O.B.E., M.I.C.E., A. C. COOKSON, M.I.C.E., C. V. DRYSDALE, O.B.E., M.I.C.E., F.R.S.(Edin.), M. SOLOMON, M.I.E.E., and G. W. TRIPP, A.M.Inst.C.E., M.I.M.E.

The marriage took place on July 31st, at St. James' Church, Piccadilly, of Mr. WILFRED GEORGE HARROLD, B.Sc., of Kobe, Japan, to Miss CHRISTINE RUSSELL KILBURN SCOTT, of Farningham, Kent, third daughter of Mr. E. Kilburn Scott, M.I.E.E.

Manchester Corporation Electricity Committee has appointed Mr. H. W. BRISTOW, at present assistant boiler-house engineer at Stuart Street station, as boiler-house engineer at the Barton power station.

The West Ham Electricity Committee reported recently that the electrical engineer had been invited by the London and Home Counties Joint Electricity Authority to act temporarily as its technical adviser, and the Authority had applied for the permission of the Council for Mr. PURSE to undertake this work. The Committee, having considered the matter, recommended the Council to consent to Mr. Purse's advising the authority, subject to 50 per cent. of the fees received by him being paid over to the Council. The report was adopted.

Mr. JOHN WADDELL, general manager of the D.P. Battery Co., Ltd., who has been with it for 33 years, and is well known as a pioneer specialist in accumulator manufacture, has been elected a director of the D.P. Battery Co., Ltd. Before joining that company on its inception, he was manufacturing batteries under the same patents at the works of Messrs. Johnson & Phillips at Charlton from 1889. Mr. E. S. NEW, M.I.E.E., sales manager of the same company, who has been with it for 27 years and was for eight years previously engaged in the manufacture of secondary batteries, has also been elected a director of the company. Mr. New founded the Accumulator Makers' Association in 1912, acted as secretary from 1912 to 1924, and is president for the current year. He has represented the accumulator makers on the B.E.A.M.A. Council since 1912, and also represents them on the F.B.I. Council, the British Electrical and Allied Industries Research Association, and the Electric Vehicle Committee.

Mr. W. J. WILES has resigned his position with the British Thomson-Houston Co., Ltd., to join Messrs. S. G. Leach and Co., Ltd., and he has been appointed a director.

The Guildford Town Council has increased the salary of Mr. M. J. DOWNING, mains superintendent, from £275 to £300 per annum. Mr. S. F. WHITING, shift engineer, has been appointed station engineer, with salary increased from £227 to £250; and Mr. C. A. WALKER, meter inspector, has been appointed meter superintendent, with salary advanced from £234 to £250.

Obituary.—MR. HENRI TUDOR, whose name was known throughout the world in connection with the accumulator of which he was the inventor, died recently at his native town of Rosport, in the Grand Duchy of Luxemburg, at the age of 69; his father was Welsh, and claimed descent from the Royal House. Mr. Tudor studied at the Brussels Polytechnic and the Paris University, and became interested in the early 'eighties in the practical use of accumulators. His first invention, which, after much research, he perfected in 1885, consisted of the application of lead oxide to a pure lead plate which had received a partial Planté formation, thus obtaining the full capacity at once without complete formation, which was a long process in those days. His next improvement, made about 1892, was to increase enormously the surface of the positive plates, so as to reduce the thickness of the Planté formation; subsequent developments were on the same lines, and also led to more rapid processes of formation For the last 15 years Mr. Tudor was an invalid as a result of his work with lead, but though he suffered much, he kept his interest in the development of the accumulator to the end. He was a very modest and retiring man, with a singular charm, and the great affection of all those who knew him was shown by the large assembly of representatives from all countries that was present at his funeral.

MR. E. C. R. MARKS.—We regret to hear of the death, on July 31st, of Mr. Edward Charles Robert Marks, a well-known patent agent and consultant, at the age of 61. Mr. Marks was prominent in the public life of Birmingham, and was at one time a member of the City Electricity Committee.

MR. C. T. CAYLEY.—We regret to learn of the death, at the age of 74, of Mr. Claude Thornton Cayley, a director of the English Electric Co., Ltd., and formerly chairman of Dick, Kerr & Co., Ltd.

MR. A. T. COOPER.—The death occurred at Tunbridge Wells, on July 29th, in his 74th year, of Mr. Alfred Thomas Cooper, who was for over 40 years an electrical engineer. He had resided at Tunbridge Wells since his retirement in 1917.

Will.—The late Mr. ALFRED ROSLING BENNETT, M.I.E.E., formerly general manager and chief engineer of the National Telephone Co. for Scotland, Cumberland and Westmorland, and later general manager of the Mutual Telephone and the New Telephone Companies, left £9,115 gross (£9,006 net personalty). Among his bequests are £100 to the Institute of Locomotive Engineers, part of the income to be used as a premium for a meritorious paper, and the balance contributed to the benevolent fund of that Institute; and £50 to the I.E.E. Benevolent Fund.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Horace Grensted, Ltd.—Private company. Registered July 28th. Capital £2,000 in £1 shares. Objects: To acquire the business of a wireless engineer and dealer in wireless and musical instruments and accessories carried on by H. Grensted at 31, Station Road, Sittingbourne. The first directors are: H. A. Grensted, Roseneath, Borden, Sittingbourne, Kent. G. W. W. Brear, Morley House, Sheerness, Kent. Qualification: £100 shares. Secretary G. W. W. Brear. Registered Office: 31, Station Street, Sittingbourne, Kent.

Hodgson & Beckett, Ltd.—Private company. Registered August 1st. Capital, £2,500 in £1 shares. Objects: To carry on the business of electrical manufacturers' agents, general electricians and contractors. &c. The permanent directors

are :—H. Beckett, 9, Delamain Road, West Derby, Liverpool; S .W. Hodgson, 27, Marine Crescent, Waterloo, Liverpool. Qualification, £1. Remuneration, as fixed by the company. Secretary : R. D. French. Registered office : Maxwell House, 6, St. Paul's Square, Liverpool.

Midland Factors, Ltd.—Private company. Registered August 1st. Capital, £500 in £1 shares. Objects : To carry on the business of wireless accessories manufacturers, electrical and general engineers, &c. The directors are :—F. Stickley, 138, Winson Green Road, Winson Green, Birmingham; F. L. Ridout, 191, Monument Road, Edgbaston, Birmingham. Qualification, 100 shares. Solicitors : R. Evans Parr, 83, Colmore Row, Birmingham. Registered office : 248, Corporation Street, Birmingham.

Mann-Egerton Finance, Ltd.—Private company. Registered August 1st, with a nominal capital of £100 in £1 shares. The objects are to carry on the business of manufacturers and repairers of and dealers in motor-cars, taxicabs, automobiles, tramcars, motors, charabancs, motor lorries, and wagons; to enter into arrangements with other companies, firms or persons for the sale or purchase of any vehicles, either by buying, selling, letting on hire, hire-purchase or easy payment system, or by financing or assisting such companies, firms or persons to purchase or sell, &c. The directors are :—G. N. C. Mann, The Oaks, Thorpe St. Andrew, Norfolk (managing director of Mann, Egerton & Co., Ltd.); G. L. Wilford, Hellesdon, Norfolk (director and general manager of Mann, Egerton and Co., Ltd.); R. A. Alston, 68, St. James's Court, Buckingham Gate, S.W.1 (director of Mann, Egerton & Co., Ltd.); A. D. Whatman, Methersgate Hall, Woodbridge, Suffolk (director of Mann, Egerton & Co., Ltd.). Remuneration as fixed by the company. Solicitors :—Russell Steward, Norwich. The registered office is at 5, Prince of Wales Road, Norwich. The file number is 232,442.

Oatway Safety Heating Co., Ltd.—Private company. Registered August 3rd. Capital, £12,500 in £1 shares. Objects : to acquire any interests in any patents, brevets d'inventions, concessions and the like relating to any invention for the production, treatment, storage, application, distribution and use of electricity and of any apparatus therefor; to acquire from J. W. Oatway the benefit of certain existing inventions relating to electric radiators, &c. The directors are :—J. Newton (chairman), "Engadina," Minehead, Somerset (director of John M. Newton & Sons, Ltd.); J. W. Oatway (managing director), 167, Chatsworth Road, Willesden Green, Middlesex (director of Oatway Bros., Ltd.); W. J. Rasey, 119, Chatsworth Road, Cricklewood, N.W.2 (director of John M. Newton and Sons, Ltd.). Qualification, £100 shares. Registered office : Marban Place, Bravington Road, Paddington, W.9.

Official Returns of Electrical Companies.

Onward Engineering Co., Ltd.—H. P. Bee, of 38, Victoria Street, Fleetwood, ceased to act as receiver on July 20th, 1928.

Strode & Co., Ltd.—W. G. Jefferys, of 66, Coleman Street, E.C.2, ceased to act as receiver or manager on July 12th, 1928.

Peranne & Co., Ltd.—Mortgage dated June 26th, 1928, to secure £1,700 charged on "Diamond Works," Regent's Park Road, Church End, Finchley, N.3. Holders : Westbourne Park Permanent Building Society.

Berry's Electric (1928), Ltd.—Particulars filed of £100,000 convertible notes authorised July 12th, 1928, and covered by trust deed of same date, charged on a sinking fund to be created out of profits and to be paid yearly to the trustees, the whole amount being now issued. Trustees : Westminster Bank, Ltd.

J. T. Kemp, Ltd.—Debenture dated July 6th, 1928, to secure £300 charged on the company's undertaking and property, present and future, including uncalled capital subject to £4,500 debentures already issued. Holder : Mrs. C. M. Kemp, 15, Rolleston Drive, Lenton Sands, Nottingham.

City Notes.

Marconi's Wireless Telegraph Co., Ltd.

In a reply to an inquirer the company stated last week that there was some misapprehension as to the nature of the scheme for a merger between the company and the Eastern and Associated Cable Companies. The merger proposals do not provide for the liquidation either of the cable companies or of the Marconi Company, and the rights of the holders of the different classes of shares in the Marconi Company in a liquidation or winding-up do not come into question. It is hoped to form the merger company as soon as the necessary legal formalities can be carried out, which must necessarily occupy some time. An offer will then be made by that company to the shareholders of the cable companies and the Marconi Company to acquire their shares in exchange for shares in the merger company. The capital of the merger company which has been allocated to the cable companies will be offered to the shareholders in those companies, and the capital allocated to the Marconi Company will be offered to the Marconi shareholders. It will be necessary for the Marconi board, in due course, to prepare a scheme defining the terms upon which the shares in the merger company will be offered to the holders of the different classes of shares in the Marconi Company. Those terms have not yet been finally settled, and the offer cannot be made until the merger company has been formed, but it is the intention of the Board that the offer of the exchange of shares shall be made not on the basis of a liquidation or winding-up, but shall be such as the board considers fair and equitable as between the different classes of shareholders.

Electro-Trust, Ltd.

The Hon. J. M. Balfour, O.B.E., presided at the first ordinary general meeting on August 2nd. In the course of his speech he pointed out that those responsible for the formation of the company felt that the present great development of the use of electricity provided many opportunities for a company specialising in electrical securities, more especially if it had Continental affiliations which would enable it to participate in European issues which were not generally accessible to British investors. They had accordingly come to a satisfactory arrangement with the Banque pour Entreprises Electriques, of Zurich. This provided that the "Electrobank," as it was generally called, would take up a substantial interest in the company's ordinary stock for cash, and would offer the company a part of the business which it undertook. A considerable proportion of the profits made during the year under review was derived from investments secured through the "Electrobank." The whole of the company's capital (£300,000) had been issued, and 15s. per share had so far been called up. The directors had decided not to publish at present a list of investments, as it might lead to premature publicity regarding the affairs of the "Electrobank."

Welsbach Light Co., Ltd.

The annual meeting was held on July 31st, Mr. J. R. Yates (chairman) presiding. After reviewing the company's affairs, the chairman said that for years past some of them had realised that only in combination was salvation to be found for the gas lighting trade, and the directors had from time to time made efforts to realise that ideal. Finally, they had discussed the matter with Imperial Chemical Industries, Ltd., which already held a preponderating interest in Lighting Trades, Ltd. (incorporating J. & W. B. Smith, Ltd.), a company which was engaged in similar business to their own, and an offer had been received from the I.C.I. This involved the exchange of I.C.I. shares for Welsbach shares, and was strongly recommended by the board. Assets representing 67 per cent. of the total issued share capital had already been received, out of the required 76 per cent., and they were still coming in freely. The present directors would remain in office, and the debenture stock would not be affected by the exchange of shares. The report and accounts were adopted.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Folkestone Electricity Supply Co., Ltd.—35,000 new ordinary shares of £1 each, fully paid, Nos. 140,001 to 175,000 (ranking for dividend from July 1st, 1928).

British Electric Traction Co., Ltd.—£2,000 deferred ordinary stock.

Postal Telegraph & Cable Corporation.—£55,746 5 per cent. collateral trust debenture stock and fractional scrip certificates. $5,461 5 per cent. collateral trust gold bonds and fractional scrip certificates.

The undermentioned have been ordered to be officially quoted :—

Marconi's Wireless Telegraph Co., Ltd.—1,195 ordinary shares of £1 each, fully paid, Nos. 3,247,626 to 3,248,820.

Application has been made to the Committee to allow the following to be officially quoted :—

Bolton (Thomas) & Sons, Ltd.—£300,000 6 per cent. first mortgage debentures.

Bridgwater and District Electric Supply and Traction Co., Ltd.

Last week this company, in accordance with Stock Exchange requirements, published particulars of its constitution and objects, prior to application being made for permission to deal in the company's preference shares. The company was incorporated in 1902 to supply electricity in the borough of Bridgwater and a number of neighbouring parishes. Its capital comprises 105,000 7 per cent. cumulative preference shares of £1 each (£52,657 issued) and 25,000 ordinary shares of £1 each (£19,982 issued). Last month the company issued 50,000 preference shares at par at a commission of 10 per cent., for the purpose of paying off the outstanding debentures (£13,400) and of providing further working capital. The directors are Messrs. C. S. Paine (chairman), W. H. J.

Masding, H. Walker, B. W. van Trump, and S. H. P. Masding. In June last £4,982 of the company's reserves was capitalised and distributed in the form of ordinary shares to the existing shareholders.

Enfield Cable Works, Ltd.

The directors have decided that in future the company's financial year shall coincide with the calendar year. The present accounting period will accordingly be extended until December 31st next, and will cover a period of 18 months. Accounts therefore will not be available until after that date, and it is proposed that the general meeting which has been called for to-day (Friday) shall stand adjourned until the report and accounts can be presented. The directors report that in their opinion trading since the date of the last accounts has been of a satisfactory nature, and they have, therefore, declared a second interim dividend of 15 per cent., payable August 11th. This makes a total of 20 per cent. for the twelve months to June 30th, equivalent to the total dividend declared in respect of the previous financial year. Mr. W. Fraser has been elected to the board.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register of Companies, and they are thereby dissolved :—

A. & A. Electrical Co., Ltd.
Grosvenor Clark Electrical, Ltd.
International Electric Railways and Water Power Syndicate, Ltd.
Magnus Electrical Appliances, Ltd.
Swan Radio Co., Ltd.
Taylors Radio Electric, Ltd.
Universal Wireless Supply Co., Ltd.
Wireless (Southampton), Ltd.

Perak River Hydro-Electric Power Co., Ltd.

In a circular to shareholders and debenture stockholders, the directors state that the progress since June 7th to the present date has been satisfactory. Negotiations with the Federated Malay States Government regarding the supply of power in bulk to the town of Ipoh have been completed, the arrangements made involving the subscription at par by the Government of 75,000 of the unissued ordinary shares of £1 each. This subscription will be a substantial addition to the company's financial resources.

Tyneside Tramways and Tramroads Co.

The report for the half-year ended June 30th shows a surplus of receipts over expenses of £1,116. The total to credit of profit and loss is £1,883, and after deducting mortgage and loan interest, &c., there is a balance of £61. Traffic receipts decreased by £1,055, as compared with the corresponding period of 1927. The directors record regret at the death of Mr. J. C. Little, the secretary and general manager.

Vickers, Ltd.

The directors have declared the following dividends in respect of the half-year to June 30th: 2½ per cent. on the preferred 5 per cent. stock, 2½ per cent. on the 5 per cent. preference shares, and 2½ per cent. (free of tax) on the cumulative preference shares.

Edmundson's Electricity Corporation, Ltd.

The annual meeting was held on August 2nd, when the report and accounts, which were reviewed in our issue of July 27th (p. 164) were adopted.

Alton Battery Co., Ltd.

The directors have declared an interim dividend of 3 per cent. on the ordinary shares for the six months ended June 30th.

Chatham and District Light Railways Co.

The directors have decided not to pay an interim dividend on the preference shares.

Atlas Light and Power Co. Ltd.

At an extraordinary meeting on August 3rd, the proposal to raise the company's capital from £5,500,000 to £6,800,000 was approved.

Northampton Electric Light and Power Co., Ltd.

The directors have declared an interim dividend of 4 per cent. on the ordinary shares.

Westminster Electric Supply Corporation, Ltd.

An interim dividend of 8d. per share has been declared on the ordinary shares.

Metropolitan Electric Supply Co., Ltd.

An interim dividend at the rate of 6 per cent. per annum has been declared.

City of Buenos Aires Tramways (1904), Ltd.

A dividend of 1s. 3d. per share has been declared in respect of the quarter ended June 30th.

Waygood-Otis, Ltd.

An interim dividend of 5 per cent. per annum, less tax, has been declared on the ordinary shares.

The Investors' Co-operative Society, Ltd.

At the first annual meeting held on July 27th, Mr. G. Morgan presiding, a dividend at the rate of 6½ per cent. per annum on the ordinary shares was declared.

Tyneside Electrical Development Co., Ltd.

An interim dividend at the rate of 6 per cent. per annum, less tax, has been declared on the preferred ordinary shares.

Rushden and District Supply Co., Ltd.

An interim dividend of 3½ per cent. has been declared.

Stocks and Shares.

TUESDAY EVENING.

Cable and Radio Merger.

THE Government have formally adopted the plan of the radio-cable merger, particulars of which have been already published here. Mr. Amery, the Secretary for the Dominions, quoted the opinion of the Imperial Wireless and Cable Conference to the effect that the only way of dealing with the problem in a manner that would control the cables and allow full expansion to wireless communication was to have a single unitary working control of the whole system. Agreement with the scheme has been expressed by the Governments of Australia, Canada, South Africa, and the Irish Free State and India. Some of the Governments wish for further time in which to examine the details; and it is possible, of course, that minor alterations will be made before the scheme is put into actual operation. It would seem reasonable to assume, however, that a settlement has been definitely reached. On account of this, the current quotations of Eastern Telegraph ordinary stock, and the shares in the Eastern Extension, Western and Globe Telegraph and Trust Companies are held to be justified in their recent vivid rises. It has yet to be seen, of course, in what proportion the existing companies will receive allotments of the stocks in the new undertakings to be formed, nor can it be said with certainty that the dividend on Eastern Telegraph ordinary, to take one example, will be necessarily raised to 17½ per cent. gross, equal to 13⅛ per cent. net, against the 10 per cent. net at present being distributed.

Congratulations.

Shareholders in the cable companies deserve to be congratulated upon the outcome of negotiations which might easily have gone agley. The fact of Eastern ordinary having been down, at one time this year, to 140, against the present quotation of 250, is in itself a testimony to the uncertainty which was felt, not unmixed with nervousness in regard to the outlook of the cable companies, *vis-a-vis* the competition which was being so successfully carried on by the wireless and beam systems. The cable companies have been in existence for more than half a century, and shareholders must feel very thankful to think that events have turned out so propitiously for their interests.

Marconi.

In regard to wireless, the position is a little different, for there is still considerable doubt as to the manner in which the merger will affect the shares of the Marconi Wireless Telegraph Company. The directors of the latter have issued a statement pointing out that the merger proposals do not provide for the liquidation, either of the Cable Companies or of the Marconi Company. Therefore, the rights of the holders of the different classes of shares in the Marconi Company, in a liquidation or winding-up, do not come into question. The merger scheme will be carried out by means of an exchange of shares, and not by the machinery of liquidation. A certain proportion of capital in the Merger Company has been allocated to the cable undertakings, and another portion to the Marconi Company. Shares in the capital of the new Merger Company will be offered to the proprietors of the respective stocks and shares in the other concerns. The effect upon the price of Marconis has been favourable, although after a rise to 67s. 9d., the quotation eased off to 66s. 3d. This leaves a gain of 1/16 on the week. Marconi Marines are firm at 50s.—when we say "firm," it means that the shares are readily saleable either at or near the middle price, and that there is a good demand for them. Marconi £1 shares, as to whose precise status in relation to the 10s. shares so much controversy has arisen, are distinctly easier on the week at 4 11/16, and the 7 per cent. participating preference stand at 4⅞, the convertible debentures being 163.

Home Railway Factors.

Attention was drawn here last week to substantial rises secured by the prices of steam railway stocks in consequence of the agreement reached over the question of salaries and wages between the companies and their employés. The spurt proved short-lived, owing to the continuance of bad traffics. Fine weather over the Bank Holiday, after Saturday's fore-

noon downpour, must have provided record crowds for the 'buses; to watch the scene at the outward terminus of any popular route last Monday was to become lost in amazement at the problem of where everybody came from. And how—incidentally—everybody could possibly get home on that same day. Metropolitan District added 10s. to its previous gain of 2 points. Underground income bonds remained at 12¼; the £1 shares at 25s. 6d. Central London non-assented ordinary stock is 2 points higher at 71.

New Issues.

Particulars have been published of the Bridgwater and District Electric Supply and Traction Co., Ltd., it being intended to make a market in the 7 per cent. cumulative preference shares of £1 each. Out of an authorised amount of £105,000 in these shares, £52,657 is issued. Ordinary shares of £1 each to the extent of £19,982 have been issued out of an authorised £25,000. The company was started 26 years ago, in a small way, with a capital of £15,000, and about four months back 36 parishes were added to its area, the new ground comprising some 137 square miles.

Bermuda and Perak.

Scottish Power new ordinary have further improved to 4s. 6d. premium. Tokyo Electric scrip is harder at 3¾ premium. Bermuda Traction new debenture advanced to 5 discount; underwriter's stock is, however, still in evidence. Dealings have started in the company's shares, of which a part was given by way of commission to underwriters. The price opened at 6s. 3d., rising rapidly to 11s. 3d. It seems a little anomalous that the company's 7 per cent. debenture stock, with participating rights of a further 2 per cent., should stand at 95 when the ordinary shares are over half-a-sovereign. It is pointed out, as a kind of justification, that Perak River Hydro-Electric 7 per cent. participating debenture is quoted at 116, while the £1 ordinary shares, which have not yet received a dividend, are 19s. 6d. The two cases are comparable, if at all, in only a rough fashion, for the Perak River scheme received British Government assistance through the guarantee given, under the T.F.A., to its 5 per cent. debenture stock, 1931-51, the price of which is 101¼.

A Pleasant Surprise.

The St. Maurice Power Company, Ltd., gives notice of its intention to redeem at 107½ the 6½ per cent. sinking fund gold bonds and 6½ per cent. first debenture stock which, according to the terms of both issues, would become repayable in 1953. They will be paid off at once—a pleasant surprise to their holders, for the price in the market has stuck for a long time past about 101. The last-recorded transaction in the stock dates back to February 23rd this year, when a bargain was done at 103. Brazil Tractions are 4 points down at 52. The preferred at 180 show a drop of 5. International Holdings have been revolving around 13, and Hydro-Electrics advanced to 29¼. Mexican Utilities are still somewhat uncertain; the Light and Power Company's 5 per cent. bonds are 2 lower at 80¼, and no rally has taken place in the preferred shares, which fell last week to 77¼.

Electricity Supply.

The Home Electricity supply shares are so quiet as to be almost stagnant. The only movements are rises of 6d. each in the preference shares of the City of London and the County of London Companies, raising the shares to 23s. 6d., at which price both give a return of £5 2s. 2d. per cent. on the money. This might be considered a yield almost absurdly small for a preference share, but, having regard to the security which both of these offer, and also the scarcity of first-rate investments of their kind, the price is not particularly surprising. Metropolitan ordinary remains at 2¾; the interim dividend at the rate of 6 per cent. is the same as that of a year ago. Yorkshire Electric ordinary have strengthened to 35s. Isle of Thanet fell ½ to 32s. 6d.

Amongst stocks and shares in companies abroad, Delhi Electric have come on offer at 2 9/16, at which they look a reasonable investment in view of the strength of the company's financial position. Shanghai Electric Construction preference rose 3/16 to-day—Tuesday—to 2¼. Whitehall preference have hardened to 24s.

Manufacturing Shares.

Manufacturing shares are leaning to the dull side, with declines in British Aluminium, Callenders, and English Electric shares. There is not much doing; many people are away for holidays, and a little selling serves to lower the prices. A fall of 10½ points in Shawinigan Water common stock left the price at 80. It is said that some of the Canadian speculators have been rather badly hit of late, owing to the consequences following upon the death of the late Mr. Alfred Loewenstein, and that, in order to raise funds, they are turning out their shares into the British markets. Consolidated Gas and Electric Light fell 2 to 81¼, Georgia Light and Power dropped a point to 60, Monterey Light and Power fell 4 to 102, in spite of quite a good report published a few days ago, and Mexico Tramway sixes at 80½ are lower on balance. Lisbon Tramways ordinary picked up to 18s. Inquiry has revived for some of the home tramway issues. London and Suburban Traction preference improved to 10s. 6d. The Anglo-Argentine shares are dull.

The iron and steel market is quiet, movements being small in either direction. The rubber share market has fallen asleep.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1926.	Dividend. 1927.	Price Aug. 7, 1928.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14†	15	8⅞	—	... ...
Brompton Ordinary	1	8‖	8½	26/6	—	5 5 8
Charing Cross Ordinary	1	8†	8½	27/-	—	5 3 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8½	8½	26/6	—	5 5 8
City of London	1	10	10	30/9	—	4 11 1
do. do. 6% Pref.	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	37/-	—	4 6 3
County of London	1	7½	7½	38/-	—	3 19 0
do. do. 6% Pref.	1	6	6	23/6	—	5 2 2
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	47/6	—	4 12 7
Kensington Ordinary	1	8	8	26/6xd	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/-	—	5 3 5
London Electric	1	8½	8½	27/-	—	5 3 8
Metropolitan	1	8	9	23	—	3 16 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/-	—	4 6 8
Mid. Elec. Power	1	—	15	39/3	—	... ...
Newcastle-on-Tyne Ordinary ...	1	5	6	35/-	—	4 16 0
do. 7% Pref. ...	1	7	7	26/6	—	5 5 8
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 7
North Met. Elec. 6% Pref. ...	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	31/-	+6d.	5 1 7
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	7	31/3	—	... ...
Westminster Ordinary	1	8‡	8‡	27/6	—	5 1 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/-	+3d.	6 5 0
Yorkshire Elec.	1	8	8	35/-	+6d.	4 11 5

Home Rails.

Central London Ord. Assented ...	Stock	4	4	78	—	5 9 7
Metropolitan	,,	8	8	67½	—	4 9 0
do. District	,,	8½	4	78	+½	5 5 8
Underground Electric	£1	1½	5	25/6xd	—	3 18 5
do. do. Income ...	Bonds	6	6	134	—	4 16 9

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101½	—	5 18 5
do Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	10	10	43.9	—	4 9 0
Eastern Extension	10	10	10	25	—	*3 19 2
Eastern Tel. Ord.	Stock	10	10	250	—3	*4 0 0
Globe Tel. and T. Ord.	10	10	10	25	—	*4 0 0
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	20	20	38	—½	5 5 8
Indo-European	25	10	10	45½	—	*5 10 0
Marconi	10/-	5	*10	65/6	+1/6	... ...
Marconi-Marine	1	8‡	12½	50/-	—	5 0 0
Oriental Telephone Ord.	1	12	12	53/9	—	*4 9 3
United R. Plate Tel.	5	8	8	9½	—	*4 2 1
Western Telegraph	10	10	10	25	—	3 19 2

*Interim.

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8‡	—	7 11 9
do. do. 2nd Pref. ...	5	6	6	8‡	—1/6	8 5 6
do. do. 5% Deb. ...	Stock	5	5	77½	—	6 9 0
British Electric Traction Def. Ord.	,,	—	—	520	—	... ...
do. do. Pref. Ord.	,,	8	7½	126	+1	5 19 1
Brazil Traction	100	6	7	52½	—1	3 6 8
Brit. Columbia Elec. Rly. Pref. ...	Stock	5	5	96½	—	5 3 9
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/6	—	... ...
London United Tram Deb. ...	Stock	4	4	60½	—	6 13 3
Mexico Trams, 5% Bonds	—	5	5	81	—	6 3 3
Mexican Light Common	100	Nil	Nil	71	—	... ...
do. 7% Pref...	100	Nil	7	77½	—	9 0 3
do. 1st Bonds	—	5	5	80½	—2	6 4 3
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Babcock & Wilcox	1	18	15	67/6	—	*4 9 0
British Aluminium Ord.	1	10	10	45/6	—1/6	*4 11 6
British Elec. Transformer Pref. ...	1	7	7	18/-	—	7 15 0
British Insulated Ord.	1	15	15	4½	—	8 10 6
Brush Ord.	1	10	10	28/3	—	7 2 10
Callenders	1	15	15	4½	—½	8 12 6
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Parkinson Pref. Ord. ...	1	—	6	17/6	—	6 17 2
do. 8% Pref.	1	—	8	26/3	—	6 2 0
Edison-Swan	4/-	10	10	12/6	—	3 4 0
do. 6% Deb.	Stock	6	6	88	—	6 13 8
Electric Construction	1	7½	7½	27/6	—	5 9 1
Enfield Cable Pref.	1	7½	7½	26/3	—	5 14 8
English Electric	1	Nil	Nil	7/6	—6d.	... ...
do. do. Pref.	1	8	Nil	10/-	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/6	—	6 6 1
do. Ord.	1	7½	10	18/6	—	5 4 0
Henley	1	25	25	6‡	—¼	4 9 0
do. 4½% Pref.	5	4½	4½	41	—	5 6 0
India-Rubber	1	Nil	Nil	18/9	—	... ...
Johnson & Phillips	1	12½	10	2	—	5 0 0
Met.-Vickers Ord.	1	8	8	30/9	—	5 18 1
do. Pref.	2	8	8	28	—	6 1 11
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	12	10	10	25	—	*4 16 2

* Dividends paid free of Income Tax.

† 4% of which was Tax Free.

Diesel-Electric Train Equipment.

Some notes on the apparatus supplied by the English Electric Co., Ltd., and Messrs. William Beardmore & Co., Ltd., for the London, Midland and Scottish Railway.

CONSIDERABLE importance is attached to the Diesel-electric trains which have recently been put into service by the London, Midland & Scottish Railway, and the following particulars of the oil-electric equipment will probably be of interest. Fig. 1 is a general view of a L.M.S. 4-coach Diesel-electric train. The objective was to produce a train which could be used in the same way as an electric train, that is, which could be successfully operated or controlled from either end by electrical means through a master switch, so as to overcome the difficulties in terminal working, besides securing other advantages.

Fig. 1.—L.M. & S. 4-coach Diesel-electric Train.

The power unit consists of the oil engine and electric generator mounted at one end of the train, and its power output is equivalent to that of the ordinary tank engine used for trains of the same weight. It is entirely electrically controlled and speed variations from the idling revolutions in a station to maximum power are obtained from control at either end of the train. It is fully automatic in all respects, and can be so arranged that two unit trains can be put together when required and worked by one man.

The engine, which was supplied by Messrs. Beardmore and Co., Ltd., is of the 8-cylinder, four-cycle, simple fluid-pressure injection type, with a 12-in. stroke, and capable of developing 500 b.h.p. at 900 r.p.m. Steel construction is practically adopted throughout and the very low weight of 14.5 lb. per h.p. has been attained. An important constructional feature is the steel monobloc crankcase in which the longitudinal and cross stresses are carried, forming a very rigid unit structure.

The engine is a self-contained unit and automatically controlled. It is complete with its own water and lubricating oil circulating pumps. The cooling water is circulated from the water-storage tank through the engine cylinder jackets, thence to the cylinder heads, and then to the radiator, which is of the spiral-tube type mounted on the car roof. The water then returns to the water-storage tank. The governor is of the totally-enclosed type and is so connected to the fuel pump controls that a plus and minus speed variation is given. An automatic overspeed cut out gear is fitted and provision is made for adjusting the governor speed range also for a hand control for speeds below the governor range.

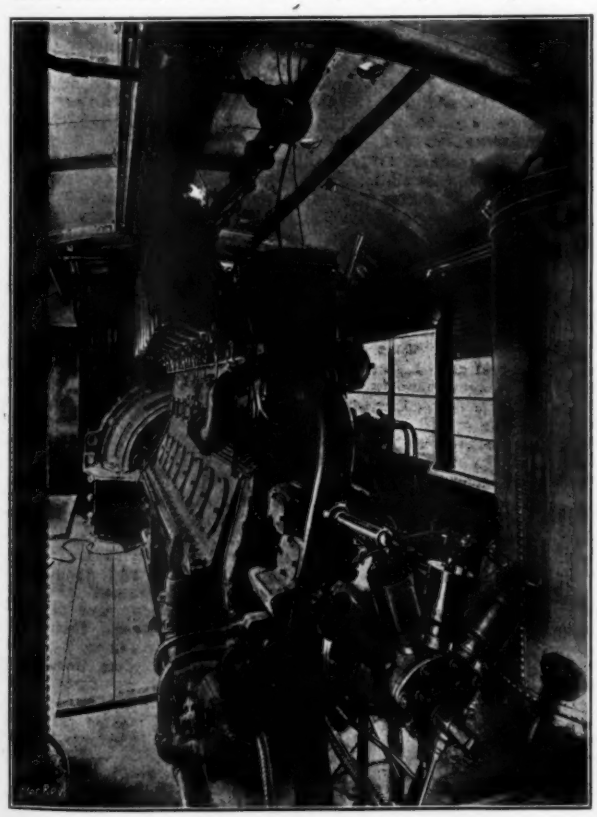


Fig. 2.—500-h.p. Diesel Set on Test.

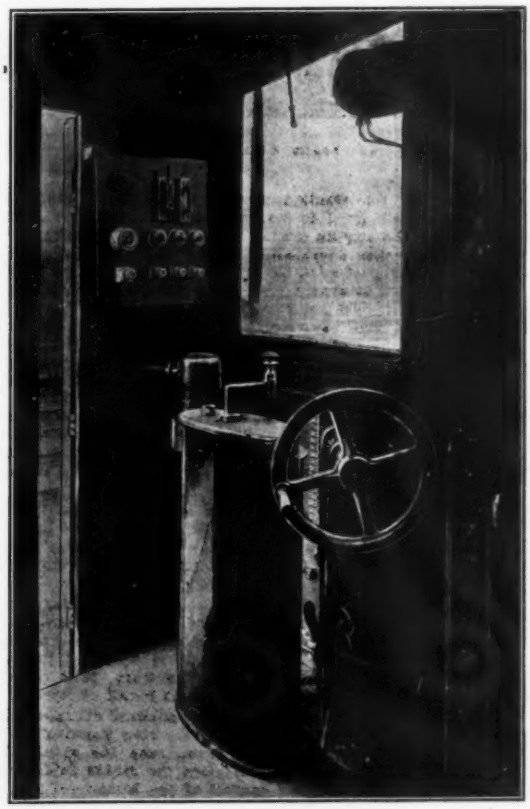


Fig. 3.—The Driver's Cab.

The engine is started by using the generator as a motor and drawing current from the storage battery, which also serves for the purpose of train lighting and driving the two brake exhausters.

Special provision is made for preventing cooling water freezing in case of exceptional atmospheric conditions; automatically, as soon as the engine stops the water drains from the radiator into the storage tank. Sufficient fuel is carried to work one day's full service.

The engine can be stopped from either of the driving positions by energising a trip solenoid to release the shutter in the intake which cuts off the supply of air to the engine. Fig. 2 shows the engine and generator mounted on the test bed at Messrs. Beardmore's Works.

A d.c. traction-type generator manufactured by the English Electric Co., Ltd., is coupled to the oil engine, and is arranged with one bearing and half coupling for bolting direct to the crankshaft with the engine flywheel. An exciter is overhung at the outboard end of the armature shaft and the whole forms a very compact unit.

In addition to its shunt winding, which is energised from the exciter or battery according to the speed of the engine, the generator is provided with a de-compounding series winding. The effect of this arrangement is that as the current

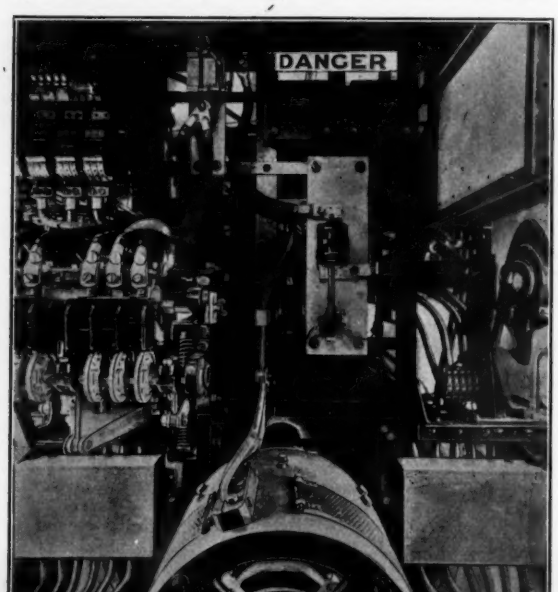


Fig. 4.—Train Contactor Equipment.

demanded by the traction motors varies, the voltage automatically adjusts itself to maintain an approximately constant torque from the engine over a wide range of operating conditions and prevents overloading of the engine. The generator is self-ventilating, the fan being carried on the engine flywheel, and is designed to give a maximum output of 340 kW at an engine speed of 900 r.p.m.

At speeds of over 700 r.p.m., the exciter, as well as energising the main field of the generator, supplies current for the various auxiliaries, *i.e.*, lighting, control operation, driving the brake exhausters and battery charging. At speeds below 700 r.p.m., these auxiliary services are fed from the battery. This was supplied by the D.P. Battery Co., Ltd., and consists of 60 K.L. 9-type cells with a capacity of 112 Ah on the five-hour rate of discharge. It is connected to the exciter for charging purposes through an automatic relay and contactor when the exciter voltage is suitable.

Two traction motors are mounted on the bogie at the trailing end of the power coach, and are each rated at 280 b.h.p. on the one-hour rating at 580 volts, with a gear ratio of 18/60. The motor leads are taken from the motors to the control apparatus mounted over the generator.

Speed control of the train is accomplished by varying the speed of the oil engines and the field strength of the traction motors. The main control gear is mounted on a framework erected over the main generator and is operated from the master controllers at either end of the train, thus obviating the necessity of turning the motor units round at termini.

The engine speed is determined by solenoid operated valves energised from the master controllers. Five running notches are provided of which the first three vary the speed of the engine and the remaining two weaken the motor fields, giving a very wide range of speed control of the train.

The field control switch is operated by solenoids with the contactors interlocked by a camshaft which ensures the correct sequence of opening and closing. The motors are connected to the generator through suitable cut-out switches and a standard solenoid-operated circuit breaker, and standard reverser determining the train direction. Fig. 4 shows contactor gear.

Specially smooth starting of the train is obtained by means of a contactor in the generator field circuit which is energised after the main circuit has been closed. Fig. 3 shows the driver's cab.

The Belgian Electrical Industry.

Declining Imports.

THE Berlin *Industrie und Handelszeitung* has recently published an interesting review of the Belgian electrical manufacturing industry. Probably in no branch of Belgian industry has the formation of trusts and the association of the banking and producing interests made such progress since the war as in electrical manufacture. This industry has been encouraged in every possible way by the Government, and its shares have been specially favoured on the bourses. Before the war the electrical manufacturing industry of Belgium was more or less in its infancy, and to a great extent under the tutelage of the German groups, *viz.*, the A.E.G. and Siemens. At present, however, it is stated that all the undertakings originally financed by German capital are independent, *e.g.*, the Ghent Motor Works, which was founded by the A.E.G.

The great aim of the Belgian Government in the field of electricity, namely, the complete electrification of the country, is on the way towards realisation, 94.9 per cent. of the districts and 91.5 per cent. of the inhabitants having electricity at their disposal. The total annual production of the country stands at about 2,500 million kWh, so that the consumption per head of population is 320 kWh, as compared with 250 kWh in Germany.

Foreign Penetration.

It is the Bank of Brussels which has devoted the greatest attention to the financing of electricity undertakings. Allied with it is the Société Financière de Transports et de l'Entreprises Industrielles, known shortly as "Sofina," which to a large extent controls not only a great proportion of the home undertakings, but also a considerable number of overseas electricity supply companies. Amongst the latter are the Neckarwerke, the Berlin Gesellschaft für elektrische Unternehmungen, the Société Générale d'Entreprises of Paris, the American and Continental Corporation of New York, the Rosario Electricity Company, the Cia. Hispano-Americana de Electricidad, and the Soc. Financiera de Industrias y Transportes, of Barcelona. In addition, it holds shares in several tramway companies, *e.g.*, in Buenos Aires, Lisbon, Lyons, Oran, Bilbao, Damascus, Smyrna, Constantinople, and Bangkok.

With another large banking group, the Société Générale de Belgique, is affiliated the Société d'Electricité de Tractions, which holds shares in electricity supply undertakings in Lodz, Smyrna, Rosario, Salonika, and the Congo.

Growing Independence.

Belgian activity has been no less marked in the domain of electrical manufacture than in that of supply. Before the war it was in the direction of telephone material that she could best meet her requirements from the products of her own factories. In other lines, *e.g.*, power plant, accessory apparatus and cables, Germany and France competed strongly with the national manufacturers. Since the war, however, Belgium has, it is claimed, made herself entirely independent of foreign imports in all lines except small domestic appliances and a few specialities. The bulk of the 60 electrical manufacturing concerns in existence in 1927 belonged to the Belgian Electrical Manufacturers' Association.

For telephone apparatus the demand last year increased substantially owing largely to the installation of the automatic system in Brussels and Antwerp. In spite of the requirements of the home market, there was a large export to Holland and Central Europe. The import of motors and dynamos is becoming more difficult owing to the expansion of home manufacture, notably in Ghent, Luxemburg, and Herstal. A similar position exists with regard to cables. Until 1914 little more than rubber-insulated wire was made in Belgium, but since then cable works on the most modern lines have been established at Charleroi, and Germany finds great obstacles to the sale of her goods in the country, particularly as the Belgian power stations only install cables made by manufacturers who belong to the Comité Electrotechnique Belge.

Some Lines Still Imported.

In the accumulator business two concerns have been established to meet the growing needs of the automobile industry, but American competition is still effective. There is still room for the sale of radio material from abroad, as local manufacture is not yet in a position to supply all home demands. For the trade in domestic appliances there is keen competition between German, American, French and Swedish firms.

The International Union of Producers and Distributors of Electricity.

A Report of the Proceedings at Paris, by our Special Correspondent.

(*Concluded from page 216.*)

AFTER the conclusion of the proceedings of the Congress in Paris a number of members and ladies took part in a visit to the Pyrenees. On July 11th the party left by a special train from the Quai d'Orsay station for Egeuzon. It is interesting to recall that the Quai d'Orsay was the first important terminal station in the world to be designed solely for electric traction. Up to two years ago the bulk of the traffic was steam operated as far as the original terminus at Australitz station, and hauled electrically through a subway under the river bank to the new station. To-day, as far as Orleans most of the passenger traffic is handled electrically without change of locomotive. The power station at Egeuzon is a few miles distant from the station and situated at the foot of a high concrete dam with two outlets to the turbines, one on each side. The dam is 61 metres high and 300 metres long, with a usable head of 58 m. 40. It is in a rocky gorge on good foundations. A feature is that it is divided up into vertical sections with expansion joints, and a number of wells have been made close up to the water face with a cross gallery, so that the state of the interior of the dam and its temperature can be ascertained and any seepage drained away. Electricity is generated at 10,500 volts and taken to a sub-station on a hill alongside, where the pressure is stepped up to 90 kV and 150 kV for transmission to Vierzon and a number of railway sub-stations on the way to Paris. The primary object of the station is to supply the railway and to give the balance to Paris and to local electrical undertakings. There are five generating units, each of 12,500 kVA, with space for a sixth. The barrage and normal water supply will give a continuous 24-hour output of 8,000 kW during three months, 18,000 kW for six months, and 28,000 kW during the remaining quarter; when utilised for peaks it can naturally give much more for a few hours per day. The lay-out is arranged so that the utmost power can be got out of the river with a minimum over the spillways. The state of the river above the station is reported by telephone, and Paris is informed as to how much spare power will be available during the next 24 hours, or more, so that they can operate their units accordingly. Further power stations are under construction on the flanks of the central plateau, and they, too, will be linked to the two big Paris companies. In the afternoon the special train took the party through Limoges to Bordeaux, passing many vineyards on the way.

The next day a visit was made to the sub-station outside Bordeaux, which is fed at 150,000 volts by a line directly from Lannemezan and supplies at 60,000 volts to a number of rotary-convertor and rectifier sub-stations. This step-down station is of the outdoor type, but the instruments and switch-operating gear are in a building alongside. Open-type cooling towers are used for the transformer cooling water. As in other stations, for the 150,000-V circuits single-phase transformers are used, star connected on the h.p. side, each of 6,660 kW. At Pessac there are two Westinghouse 15,000-kVA synchronous condensers fed off a third winding on the step-down transformers at 6,600 V. This station provides a certain amount of power for the Bordeaux power supply authorities.

The party was then royally entertained at a luncheon at the old world chateau of Talence by Mr. Ellissen, who is largely interested in both gas and electricity concerns. On the Continent in many cases gas and electricity supplies are closely allied. In the late afternoon the party left Bordeaux by special train for Pau, the train being drawn by a four-motor locomotive of the type built by the Constructions Electriques de France of Tarbes (which is allied to the English Electric Company).

On the following day the party left for the valley of the Osseau, where the members visited the power stations at Hourat (200 metres fall), Miegebat (500 metres), and Artouste (800 metres). The two former are in operation; the third awaits certain head works, some at an altitude of over 6,000 ft., which can only be undertaken betwen July and September. The headrace is 8.7 km. long in tunnel. A feature of the development is the way in which converging streams are tapped high up by a longitudinal conduit, so as to give a greater head and to enable water to be taken higher up the valley into the storage lake. At Hourat 750-kW rotary convertors were seen operating directly at 1,500 volts for the d.c. traction on the Midi Railway.

It was gleaned that the hydraulic power authorities, both in France and Italy, were taking a great interest in afforestation as increasing precipitation and reducing the damage to timber by floods, and facilitating economic power development. The party lunched at Eau-Bonnes as the guests of the Eastern Pyrenees Electricity Union. On the journey to Lourdes the Arbusque Pass was traversed, a wild district dotted with herdsmen's huts; it was, however, remarkable to note how villages over 2,000 feet up were supplied with electricity.

On Saturday a visit was first paid to the Lannemezan main sub-station, the centre of gravity of a group of power stations owned by members of the West Pyrenees Power Union. The arrangement at this station is based on the idea of getting the utmost power out of the water available with the aid of a purely voluntary organisation. Owing to inductive interference with Post Office circuits in certain narrow valleys, the 150,000-V circuits were not in operation at the time of the visit, but it was expected that they would be running again shortly. From the point of view of power supply these circuits had given every satisfaction.

It was noted that there were no lightning dischargers or other protective apparatus in operation on the 60,000-V circuits, and it was explained that experience so far had shown that their connection to the circuit had been of little value.

The party went on to Luchon, which has an altitude of 630 metres, and from there by rack railway to Superbagnéres (1,800 metres), and lunched as guests of the Midi Railway Company at its remarkably arranged hotel, looking over the valley on one side and over some of the highest mountains in the Pyrenees on the other. At the luncheon one of the directors of the Midi Railway pointed out that his company not merely transported goods and passengers, but also, by means of its interconnecting lines, transported power to aid industry and agriculture. The rack railway works at about four miles per hour with a three-phase supply, taking about 40 minutes on the journey. Going up the current failed for a moment, and an automatic governor came into play which applied the brakes. On the rolling ground outside the hotel at the top of a slope a three-phase electric motor and winch on a trolley with a wire rope were to be seen in a little hut, fed by a three-phase line from the hotel sub-station. It is so arranged that during the winter the trolley can be run outside and arranged to haul snow ploughs and enthusiastic winter sportsmen and sports-ladies up the slope.

After lunch two power stations belonging to the Cie. Electricité Industrielle were visited. This company was started during the war to supply nitrates and other electrochemicals; at present part of the current is used for electrochemical work, the remainder being handed over to the Power Union. The water comes mainly from a collecting area at an altitude of over 5,000 feet, with a rainfall of about 80 in. per year. Several glacial lakes assist in the regulation. The company has three stations. The Lake Oo station is supplied from a storage lake high up in the mountains. To prevent trouble from excessive pressures and to diminish the water loss, some of the water head from the lake above is broken before the water passes into the intake canal, which is 8 km. long; the utilised fall is 800 m., with four Escher Wyss-British Westinghouse Pelton turbine sets, each of 7,000 h.p. Each unit runs at 1,500 r.p.m., and the electrical end is of the steam-turbine type. The lake will hold nearly 15 million cu. m. of water.

A second station, Pique Inférieure, has four Francis Escher Wyss turbines, 1,000 r.p.m., 165 metres head, 2,000 kVA, with British Westinghouse generators. The machines are wound for 10,500 volts. A third station, higher up the mountains, has five Francis turbines, 3,100 h.p. each, 10,500-11,000 volts, 218 metres head.

The three stations are linked together at 10.500 volts at the Lake Oo station, where the power is stepped up to 60,000 volts. In 1926 the coefficient of utilisation of the three stations reached 96 per cent. In the evening the party was entertained by the Cie. d'Electricité Industrielle at the Casino at Luchon.

On Sunday, July 15th, the party had a long drive to Ax-les-Thermes, along the Route-des-Pyrenees, which is being developed by the Ponts-et-Chaussées Department, with the co-operation of the Tourist Development Department of the Midi Railway.

The next day's journey was up the valley of the Ariége to Hospitalet, close to the frontier of the Republic of Andorra, and across the wild pass of Puymoreus (1918 metres altitude) which separates the watershed of the Garonne from that of the Tet, which falls into the Mediterranean. On the way up one noted the works of the second Transpyrenees Railway, with gradients of 1 in 25, and a summit tunnel 5.3 km. long, about 1,000 feet below the top of the pass. The railway will be opened next year, and will link up Toulouse with Barcelona. At a number of points lattice steel standards

for 1,500-volt d.c. operation were being put up. Over the pass a number of towers for the linking up of the power stations under construction in the Valley of the Tet were being bolted up for erection. The road twisted and wound down into a remarkable wide rich valley of the Cerdagne, served up to now on the French side by a narrow-gauge third-rail electric railway, belonging to the Midi Railway Company, and operated with d.c. at 850 volts, running from Villefranche de Conflent to Latour de Carol on the Spanish border. The route to Carcassonne was followed down the valley of the Aude past, an old frontier fort built by Vauban. On entering the valley a concrete dam and headrace were seen under construction, and in a gorge, which stretched for about twenty miles, one came upon headworks, temporary transformer stations, contractors' tramways, ballast pits, and so on, showing that extensive hydraulic development work was in progress. Some smaller stations have been at work there for some time. The road wound around canyons in a remarkable way; in many places rock had been blasted out to give any room for a roadway at all possible.

Carcassonne was reached in the early evening, and after dinner many members went towards the old Citadel, which was illuminated in outline by electric light for the "2,000-year celebration" of the foundation of the city. One certainly wondered what Simon de Montfort and his knights would have thought of electric light and power.

From the beginning of the Congress to the end of the excursion at Carcassonne visitors from other countries had many remarkable experiences of the hospitality of French public bodies, railway and power companies, and private individuals, and of the willingness of all to explain those little details which make technical matters of value and interest. The success of the Second Congress of the Union Internationale des Producteurs et Distributeurs D'Energie Electrique was in no small measure due to the organising capacity of Mr. Brylinsky and of his secretary, Mr. Marty. The next Congress will take place at Brussels in 1930, under the presidency of Mr. Raoul Lechien, managing director of the Cie. Auxiliaire d'Electricité. Mr. Tarby, of the Mauritius Power Company, was the only representative of British power undertakings, but it is to be hoped that within the next two years British power undertakings, both municipal and company, will take some steps to see that at an international congress of the kind due justice will be given by representation to the progress which has taken place at home.

An Electric Fire-Alarm System.

Some features of the Beasley-Gamewell apparatus made by the A. T. M. Co., Ltd., which functions on the closed-circuit principle.

As the manufacturer of Beasley-Gamewell fire-alarm equipment, the principal exhibit of the Automatic Telephone Manufacturing Co., Ltd. (having abandoned its original system, which was described in our September 2nd, 1927, issue) at the annual congress of the Professional Fire Brigades' Association at Portsmouth in May comprised a range of positive non-interfering succession street alarm boxes, together with sector boxes which fulfil the less exacting requirements of small towns, urban areas, &c. Both types are designed for closed-circuit working, being constantly energised and self-recording in the event of a failure at any point along the lines connecting the boxes with the apparatus at the fire station, which protects the brigade staff by making permanent records of the exact time, date, and origin of all calls received.

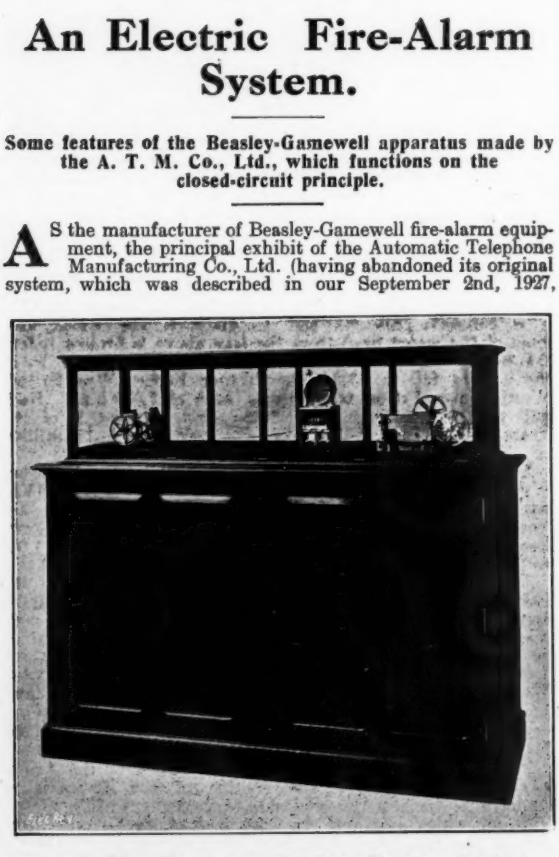


Fig. 1.—Date Stamp and Punching Register Cabinet.

On a polished-oak switchboard an enamelled-slate panel is mounted to which are attached the keys, switches, measuring instruments, &c., associated with the loop circuit. At the top of the switchboard is an opaque glass panel for the display of luminous signals indicating various conditions, *e.g.*, broken or earthed line, &c.; cords, plugs, or other temporary connections are dispensed with entirely, the whole of the essential switching operations being effected by means of well-proved keys, or switches. The audible signals are received on an electro-mechanical gong of the "turtle" type, whilst the box codes are recorded on a travelling paper tape by perforations, and the time and date are impressed by a stamp. The punching registers, clock, and date stamp are accommodated in a polished oak cabinet with a glass-panelled top (fig. 1). In the event of a line being broken, or a box short-circuited, the signals will be recorded on an auxiliary register located in the same cabinet, the usual audible bell signals being sounded, at the same time giving due warning of the existence of the fault. This is an all-important and exclusive feature of Beasley-Gamewell street fire-alarm boxes, which are operable on the breakage of a glass control panel and the pulling of a lever, but whereas the former (fig. 2) has stored energy in a spring wound by the fire brigade staff (and, once released, is capable of sending fifteen repeat signals, and of challenging the line and cutting itself into circuit at the beginning of any series of four signals) the sector box (fig. 3) requires the depression of its lever by the person sending the alarm to wind its mechanism, and then sends out four complete signals when released. Simultaneous operation of two or more succession boxes on the same loop will not affect the issue, and all signals, from whatever box, will reach the station without mutilation, a vital factor in large city networks.

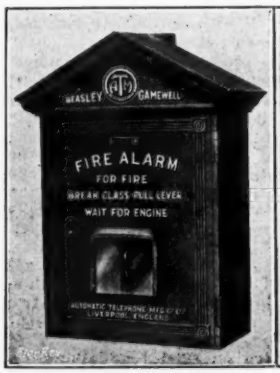


Fig. 2.—Succession Street Alarm Box.

Fig. 3.—Sector Street Alarm Box.

For those fire chiefs who prefer the telephone method of communication between public and brigade there is the A.T.M. telephone fire-call box: outwardly it resembles a sector box, but a loud-speaking receiver, audible within a radius of twelve feet, and an associated microphone for the use of the person giving the alarm replace the coding mechanism. Breakage of the glass control panel causes the door of the box to open automatically, exposing both receiver and microphone, together with the necessary instructions in unmistakeable type. In opening, the door releases a spring switch which drops an indicator on the first station switchboard; the fireman on duty immediately challenges the line and asks particulars as to the nature and location of the outbreak, his voice being audible to the person at the box.

Another item of the exhibit was an automatic repeater of signals received at the central fire-station to outlying sub-stations, which takes the form of a relay group and rotary line switch similar to those in everyday use in Strowger automatic telephone exchanges the world over. In addition to receiving and transmitting signals the A.T.M. repeater also gives visual indication of the loop over which the call is being transmitted.

Finally, the Company exhibited its firemen's call-bell system, comprising a switch cabinet on which are mounted a series of keys corresponding with the members of the brigade, and labelled accordingly. When a fire call comes through, the station attendant presses a master key and thereby rings the bells of all men whose individual keys are in the "duty" position. The circuit is so arranged that any one bell can be run at will, whilst a test key permits of the simultaneous testing of all bells.

The whole of the A.T.M. Company's exhibit was arranged for continuous demonstration as required throughout the Congress.

The Factories and Workshops Report.

Some of the Observations of H.M. Inspectors during 1927.

THE annual report of H.M. Chief Inspector of Factories and Workshops for 1927* deals at somewhat greater length than usual with accident prevention, a subject which is receiving much attention just now. During the year under review singular variation in the activities of certain trades was evident, marked depression in some coinciding with phenomenal briskness in others. Mr. G. Bellhouse, H.M. Chief Inspector, records notable development in electricity generation, manufacture of electrical apparatus of all kinds, and in electrical engineering generally.

Electrical Inspector's Report.

One chapter is, as usual, devoted to the report of the senior electrical inspector, Mr. G. Scott Ram, O.B.E., M.I.E.E., who states, *inter alia*, that the number of reportable accidents notified during the year was 372, including 27 fatal cases, against 338 and 17 for the previous year. The increase is more apparent than real, being attributable to the figures for 1926 having been abnormally low, on account of slackness of work in the heavy industries due to the coal miners' strike. It is a remarkable fact, which Mr. Ram thinks is directly due to the influence of the Regulations, combined with inspection, that the number of accidents is actually less than it was 15 years ago, although during that period the generation and use of electrical energy has increased many times over; 28 of the accidents occurred on high-voltage systems, 22 of them being at stations of public supply or traction undertakings. It is noteworthy that only four of these were fatal, the disabling injuries in the other cases being chiefly from burns. Most of these accidents occurred to persons carrying out work other than routine operations at switchboards.

In the case of seven of the accidents the injured person was knowingly and deliberately taking a risk in working on high-voltage switchgear close to unprotected live conductors. In seven cases accidents were due to mistakes on the part of the worker, or the foreman, in thinking that the conductors were dead when they were not; one had fatal results. In another case, a man actually put a spanner on to a live nut at 11,000 volts, without being killed, although he was badly burned. In three cases shocks were received from conductors through a number of layers of so-called high-tension insulating tape; in previous reports Mr. Ram has referred to fatal accidents through persons relying upon the efficacy of such tapings. In another, through a misunderstanding between two qualified men about to do some work on a switchboard, one of them took hold of a 20,000-volt conductor, but, although severely burned, he recovered from the shock.

In the case of 21 of the fatal accidents the voltage of the shock did not exceed low pressure. Although in 10 of the cases the system was 3-phase, 4-wire with an earthed neutral, the pressure between phases being from 400 to 440 volts, the shock was received from one conductor to earth, and not between phases; in many of them the circuit in question only comprised one phase and the neutral. Portable hand lamps again accounted for several fatalities: in one case the lamp was of a type, condemned annually in these reports for over 20 years, consisting of a brass fitting directly in connection with the lampholder. The general adoption of lampholders made entirely of insulating material in respect of the external parts would go far towards eliminating lampholder fatalities. Somewhat exacting qualities are necessary in the material used, which must also be capable of being moulded, and as generally happens, the best is the most expensive and a compromise has to be adopted. Thus, in general, whatever the material used the time allowed under pressure and heat in the mould is an important factor in ensuring some of the necessary qualities in the finished article, but obviously the longer the material has to be kept in the mould, the more expensive becomes the product, as fewer articles can be turned out in a given time. Recently, lampholders and other articles moulded of "Bakelite," have been put on the market and, should they prove satisfactory in use in respect of the several necessary qualities, their advent will mark a useful advance in the design and development of small electrical accessories.

Two fatalities occurred in the use of unearthed portable electric drills, and another in the use of an unearthed portable saw-bench. Another electric tool (chisel) fatality was investigated, but is not included in the table, being non-reportable, as only members of the family were engaged in the works; the last case emphasises the necessity for the use of properly constructed connector plugs. The one in use was of foreign manufacture and made only intermittent contact. The user, a stonemason, thinking the tool was at fault, started to dismantle it without first switching off and received a fatal shock.

A double fatality which occurred in the construction of a new dock, and was consequently non-reportable, was due to the non-earthing of a crane combined with the use of inadequately protected flexible wires. Four fatalities occurred to persons coming into contact with the trolley wires of travelling cranes; one case occurred to a crane driver whilst in the driving cabin, but careful investigation failed to reveal exactly how he received the shock.

Another fatality was of interest in showing how an extremely brief contact may have fatal results: a man in an ironworks was killed while raising an iron rake with which he touched a bare place in an otherwise insulated overhead conductor carrying 230 volts alternating; the contact could have been only momentary.

One fatal accident happened on a direct-current circuit at 220 volts, a very rare occurrence. An electric radiator of a common, but very badly designed, type was in use in a workshop having a tiled floor. Several men were sitting round it during their dinner hour and one of them, a normally healthy man, 21 years of age, accidentally knocked it over on its back, with the result that the iron casing became live, his foot remaining upon it. This accident brings to light the dangerous construction of certain patterns of electric radiators commonly met with.

An accident at an ironclad motor-control switchboard indicates the danger of having any live metal exposed on such a board. All conductors were enclosed except the terminals of an ammeter, which had probably been added at a later date. An attendant inadvertently touching the ammeter terminals, whilst his other hand was on the earthed case of a motor starter, received a fatal shock (440 volts).

Of the non-fatal low-pressure accidents, 30 occurred in the renewing of fuses, 41 at motor control panels, 37 in the use of portable apparatus, 54 with connector plugs and flexibles, and 22 in the testing of electrical plant.

Some medical practitioners still do not appreciate the potential value of prolonged treatment (artificial respiration) in cases of insensibility or apparent death, from electric shock. In six of the fatal shock cases referred to above, artificial respiration was carried out until the arrival of the doctor, who pronounced life extinct within a few minutes of the accident. In some cases it was, however, apparently carried out efficiently, but unsuccessfully. In one accident two men were rendered insensible by a high-voltage shock, and the treatment succeeded in the case of one man but not of the other. In another accident three men were rendered insensible by a low-pressure shock, two recovered under treatment, but the other succumbed. Generally, in power stations prompt and efficient treatment by members of the staff is forthcoming; in one station treatment promptly started by the staff was continued under the supervision of a medical man, and proved successful after 2 hours, and in another, although unsuccessful, was continued for half-an-hour after the doctor had pronounced life extinct.

Each of the Electrical Inspectors reports very marked activity in electrical development throughout his area. Several new generating stations were completed and others were in course of construction, whilst extensions were made to many of the existing stations. On the other hand, several generating stations became sub-stations, taking bulk supplies for local distribution. More stations were linked up and transmission and distribution mains extended into districts not previously served. In accordance with the scheme of the Electricity Commissioners the number of sub-stations will continue rapidly to increase. The term "sub-stations" embraces widely differing types; in some cases a compromise has been adopted by placing the transformers out of doors and all switchgear within buildings, and in general this arrangement has resulted in a higher degree of safety to employés. With the completely outdoor type of sub-station having bare conductor connections, difficulties arise when any section has to be worked upon, as when, say, an oil switch requires overhaul, if a complete shut-down of the sub-station is to be avoided; either there must be permanent divisions or suitable screens between sections, or the spacing of the sections must be so ample as to eliminate any risk of contact with an adjoining live section. In this connection the carrying of tools and material should not be overlooked and isolating switches should be operated from the ground level by means of fixed levers so as to avoid the use of portable poles. Similarly, fixed ladders should be provided where necessary and their lower parts should be provided with hinged boarding with padlocks to prevent unauthorised or inadvertent use of ladders leading to live gear. Some of the early examples of outdoor sub-stations appear to have been designed regardless of the safety of the attendants, precautions adopted as a matter of course in the case of sub-stations in buildings being ignored, whereas even greater care is necessary by reason of the fact that the plant being out of doors may have to be operated in wet and stormy weather.

Owing to the greatly increased power in generating stations, and to the linking up of stations, some of the existing switchgear in sub-stations is proving to be inadequate under fault

* H.M. Stationery Office, Cmd. 3,144. Price 2s. 6d. net.

conditions, especially when near to the generating stations. Whilst some kiosk type transformer stations are well and safely designed, in others even the high-voltage conductors are exposed quite unscreened when the door is opened for access to the switchgear.

In the case of small local supplies taken from a high-voltage system, the cost of an oil circuit-breaker is a serious item and alternative ironclad oil-immersed switch-fuses are under trial. Mr. Swann (Eastern area) reports that a number in use in his area appear to give satisfaction, whereas Mr. McColgan (Northern area) points out that it is not always realised that the sizes of switchgear and fuses required for controlling a circuit should not be governed merely by the current which the circuit normally takes, but by the heavy kVA which may flow into a fault from the system to which it is connected; this rule applies to low-pressure as well as to high-pressure gear. He also refers to the not uncommon practice of allowing non-technical persons to renew fuses or adjust circuit breakers of motors for lifting machinery.

Mr. Brown (Midland area) refers to the large increase in the output and plant capacity of the power stations in his area, where three new capital stations were opened during the year. In the switchgear several new features tending to secure reliability and safety in operation have been introduced. Several cotton and woollen mills changed over to electric drive; in two cases generating stations were constructed, but he also cites an example of a large paper mill which shut down its own station and effected a considerable saving by purchasing electricity from the public mains, as the process did not require the whole of the exhaust steam from the turbine.

Mr. Swann (Eastern area), in describing new generating stations for public supply, refers to a novel feature in one of them where the turbine plant and the boilers are all in the same room without any wall or division between. This departure from the usual practice indicates the advances which are taking place in methods of boiler firing and the handling of coal and ashes whereby a boiler house need no longer be the seat of uncontrolled dirt and dust; in the case in question powdered fuel is used. As in the case of other electrical inspectors, he reports an increasing number of inquiries from electrical manufacturing firms, consulting engineers, and occupiers as to the design and lay-out of electrical plant and apparatus. Although such inquiries often involve a good deal of time they are well worth while, as they often prevent mistakes which would have otherwise led to much difficulty and expense had the points not been considered before the plant was erected. In several cases his investigations have incidentally led to the simplification and greater efficiency of the processes. A new process of steel melting in the manufacture of the finer and more expensive grades of "crucible" steel has been put into use on a commercial basis; alternating currents of higher voltage and higher frequency than in the arc electric furnace are used, the heating being by currents induced in the metal itself; safety of the workers has required special consideration.

Mr. Preston (Western area) points out that in many sub-stations fitted with excellent high-voltage switchgear of the draw-out truck type, the arrangement is rendered unsatisfactory by the inclusion of other panels of the cubicle type equipped with instrument transformers and fuses which it is impossible to isolate safely, necessitating at times the complete shutting down of the sub-station, or the running of serious risks by the attendants. Amongst defects in factory installations he refers particularly to the failure to provide means for isolating the starting apparatus of motors, the use of unsuitable switchgear, and inefficient methods of earthing. Amongst the new works in his area are two extensive factories belonging to foreign firms: a great deal of attention has been necessary in regard to their electrical equipment, particularly in respect of one of them using foreign plant, the original proposals having been quite impossible from the safety point of view.

Eight prosecutions for breaches of the Electricity Regulations were taken during the year. Convictions were obtained in six cases, fines varying from 10s. to £50, with costs, were obtained. Two cases were dismissed under the First Offenders' Act on payment of costs.

Electric Accumulators.

Under the "Dangerous Trades" heading it is recorded that a number of important works under the Electric Accumulator Code were remodelled and enlarged, and conditions were not always satisfactory while the work of reconstruction was in progress. Mr. Beard (South Birmingham) writes of one very large works: "Three-quarters of the cases of poisoning are due to the movement and handling of pasted plates . . . and arrangements are in train for a system of mechanical handling which should be of the greatest value in reducing the risk of poisoning. In lug milling this is already partially in operation; one automatic machine now completes three processes, saves more than two-thirds of the handling, and removes loose dust at the delivery end."

Neglect of minor sources of lead dust often involves danger; Miss Dunch (North London) says: "Much attention has been given to the method of dealing with the cloths used by the pasters as the drying of them appeared to be a cause for accumulation of dust. Paper has now been successfully substituted for the cloths, and it is hoped that this will remove what appeared to be a danger."

The medical inspector states that activity in this industry has continued, and 58 cases were notified, being an increase of six over those of 1926. Twenty-four of the cases, as compared with 14 in 1926, occurred in work involving exposure to dust from pasted plates, in such occupations as trimming, trucking, and packing, where it is difficult, and in some cases impossible, to control the dust effectively. With the exception of lead burning, which accounted for six cases, as compared with three last year, and casting, with two cases as against six last year, the incidence in other processes remains much the same. One large works appointed a whole-time works doctor, following the establishment of a dental clinic.

Lighting.

The work of bringing to the notice of employers the recommendations of the Departmental Committee on Lighting in Factories and Workshops continued. Two members of the staff were again detailed to take readings in various industries during the winter months.

Miss Coombes found that the depression in the textile industries reduced very considerably the time during which artificial light was in use, and this factor set a limit to the number of readings taken. On the other hand, she had more time to discuss lighting matters with persons interested, and she emphasises the advance noticeable since 1926; there were signs of a much wider grasp of the principles of good lighting. It seems that the concentrated propaganda carried out by the more scientific illuminating engineers and others has filtered through to the man at the works who is responsible for lighting conditions. The chief problem in many departments of textile factories is that of obtaining equality of illumination on the whole length of the very large machines.

Miss Coombes took 173 readings in cotton mills on processes for which a standard of 3 foot-candles would probably be recommended, and 109 were below this standard. In woollen mills, on processes for which a similar standard has been recommended, 52 readings were taken, and of these 20 were below 3 foot-candles. Miss Meiklejohn, in her visits to woollen mills in Scotland, noted improvements effected and increasing attention given to the lighting of such departments as weaving sheds, burling, picking, shading and darning, in all of which the work involves considerable eye strain if the light is inadequate, or improperly arranged, or shaded. In the case of darning, the ordinary electric bulb, even when shaded, caused glare, and blue glass bulbs were substituted for this particular work. In another works in the Southern Division, where blue "daylight" lamps were installed in the press shop, the manager attributes diminution of fatigue and increased production on night shifts directly to these lamps.

Mr. Shopland found the standard of illumination highest in the boot and shoe trade, only four of the readings taken being under the recommended standard of 3 foot-candles; 54 of the readings being 5 foot-candles and over, while 18 exceeded 20 foot-candles. The standard was found to be low in the engineering trade, where of 124 readings taken 25 were below 3 foot-candles. The general arrangement of lighting systems was bad in many cases, light sources not being in the most effective positions to illuminate working planes satisfactorily and shadows were frequently cast on critical points in machine work. Taking his readings as a whole, the standard employed fell in at least 30 per cent. below that recommended by the Committee on Factor Lighting, not through any inadequate quantity of light, but through faulty distribution of the light sources, accompanied by insufficient shading. Glare is generally present owing to the use of shallow shades with deep bulbs. Where the lamps are in close proximity to the workers engaged on very fine work, headaches are common; the glare seems to be accentuated by the use of gasfilled electric lamps in place of the vacuum type. Where the shades were in very close proximity to the workers in such very fine work as needle heading, complaints were heard of unpleasantness caused to the face by heat radiation. In a large number of cases reflectors and lamps were found in a dirty condition; many sources could not be adjusted by the workers to the most suitable position.

Reports from all the Divisions show that this question is receiving more and more attention from occupiers, and that improvement, though gradual and slow, is very noticeable, especially if a comparison is made with the conditions obtaining only a few years ago.

Electricity Regulations at Coventry.

Arising out of the recent accident at the Coventry Public Baths, when a boy received a fatal electric shock by catching hold of two loose electric wires, the City Council is making regulations for the supervision of all electrical fittings in public buildings under its control, and is arranging that all electrical work, whether of a temporary or permanent character, shall be executed by properly qualified electricians, the work to be tested and passed by the Electricity Department. The Department is also to arrange for a general inspection, at least once a year, of fittings in all Corporation buildings.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Bakelite Electric Bell.

An addition to the bakelite products of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, is the "Magnet" electric bell, fig. 1, which is made in two sizes with 3-in. and 4-in. round and sheep gongs, respectively. The base and cover of the bell are made of bakelite, and

Fig. 1.—A Bakelite Electric Bell.

the frame is an armature-iron pressing. The terminals are completely enclosed in the bell box, which is of the pillar type and fitted with cheese-headed screws. The bell is provided with rubbing contacts fitted with gold-silver points. To prevent the armature being pulled out of alignment, the contact spring is bent over on the bell frame to anchor it.

A New House-Lighting Set.

A recent production of Messrs. PETTERS, LTD., Westland Works, Yeovil, is the radiator-cooled "Petter-Light" house-

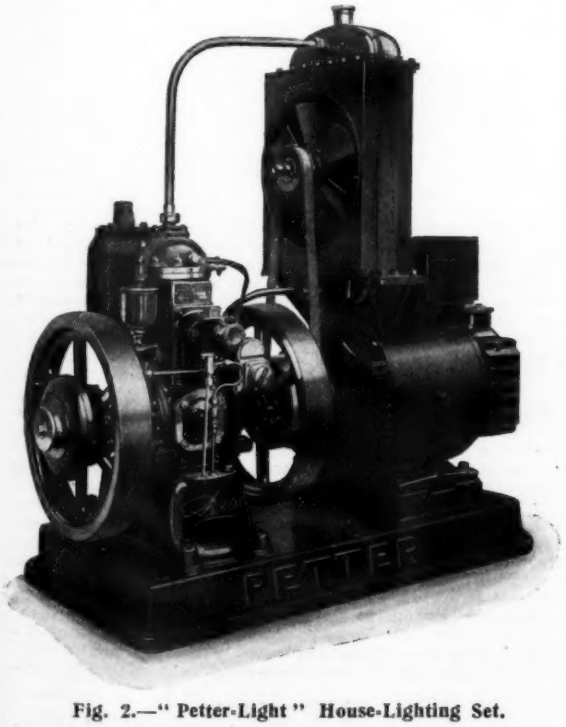
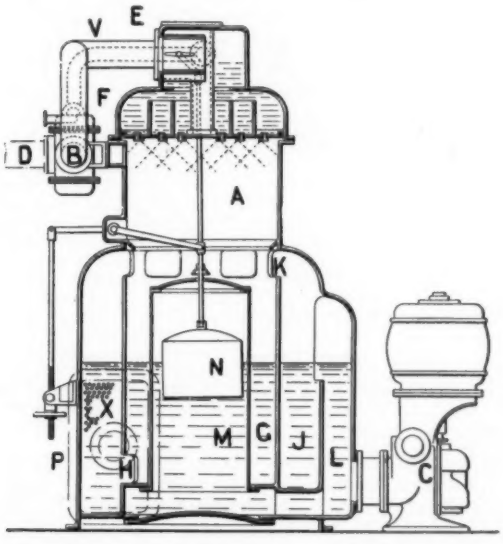


Fig. 2.—"Petter-Light" House-Lighting Set.

lighting plant shown in fig. 2. It is self-contained and compact, and can be carried about and operated on a lorry or other vehicle. The importance of the radiator cooling is revealed by the fact that it does away with the need for separate water tanks and piping. An important feature claimed for the engine is exceptionally smooth running produced by the two-stroke cycle of operations. Further, there are no valves working in the heat of the combustion chamber, and no valve gear to get out of order. The complete set consists of a water-cooled Petter paraffin (kerosene) or petrol engine, dynamo, special switchboard, radiator for cooling water with a fan, and a "Petter-Light" storage battery with a wooden stand. Touch-button starting is arranged for. The engine is directly-coupled to the dynamo, and the radiator fan is driven by belt, the switchboard being mounted on the dynamo and provided with a switch for motoring the engine at starting. The battery is supplied complete with acid, insulators, separators, connectors, hydrometers, and the wooden stand, and is fitted with acid-tight lids. The plant is supplied in two sizes, 1 and 1½ kW, for either 32- or 50-volt circuits.

A New De-aerator.

The Weir "Optimum" de-aerator, the latest production of Messrs. G. & J. WEIR, LTD., Cathcart, Glasgow, has resulted, it is claimed, in simplification in process with improved performance and reduced costs. It permits violent ebullition at all temperatures of water, provided that the



A, de-aerator body; B, ejector coolers; C, water-extraction pump; D, water inlet; E, control valve; F, spray nozzles; G, intermediate compartment; H and L, communication parts; M, central compartment; N, float; J, water compartment; P, steam inlet; V, air pipe; X, distribution plate.

Fig. 3.—The "Optimum" De-aerator.

temperature of the entering steam is higher than the leaving temperature of the water. It is claimed to give excellent de-aeration at low as well as high water temperatures, and it can be installed in existing stations with the minimum of expense and dislocation. The sectional view of the apparatus, fig. 3, depicts the working arrangements. The cold untreated water enters at D and passes through the coolers of the ejector B; the operating steam of the ejector is thereby condensed and the temperature of the water raised a few degrees. The water thereafter passes through the control valve E, under the control of the float N, to the spray nozzles F. The float gear is arranged so that the float does not normally require to operate any spindles through stuffing boxes, and a hand-operating lever or handwheel is provided to test the gear for binding. The water extraction pump may be either motor or steam driven, and is designed to withdraw from the highest vacuum which will obtain when the steam to the de-aerator is shut off and only cold condensate is entering the de-aerator. The pump discharge pressure is normally 15 to 20 lb. per sq. in. The air ejector is of the three-stage type and designed to reduce the partial air pressure to the lowest limits. The operating steam pressure necessary is not less than 150 lb. per sq. in. The plant is self-contained and requires only inlet and outlet water and ejector steam connections.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The East Notts. Special Order.

A principle of considerable interest to electricity supply and colliery undertakings was considered by the Special Orders Committee of the House of Lords on August 1st. A Special Order (the East Nottinghamshire Electricity Special Order, 1928), made by the Electricity Commissioners, and confirmed by the Minister of Transport, has been submitted to the House for approval. It is promoted by the Derbyshire and Nottinghamshire Electric Power Co., and its purpose is to confer powers upon the company for the distribution of electricity for all purposes within a large area in Nottinghamshire, in which there are collieries possessing their own generating stations, and supplying electricity for the purposes of their undertakings, as well as to the community for other purposes. Opposition to the passing of the Order in its present form was put forward by the Butterley Co., Ltd., colliery owners, &c., the Bolsover Colliery Co., Ltd., and the Mining Association of Great Britain; the purpose of the opposition was to secure more adequate protection against interference with their mains by the Power Co.

Mr. C. B. Marshall, for the Butterley Co., said that his clients owned twelve colliery undertakings, one of which, the Ollerton Colliery, being situated in the parish of Ollerton, was within the area in which the Power Co. sought powers to supply. In order to house its employés, the company was building a new town or village. Upwards of £335,000 had already been expended by the company upon the creation of the village, and it was anticipated that a further sum of at least £300,000 had yet to be expended. No supply of electricity being obtainable from the Power Co. on economic terms, the Butterley Co. had constructed a generating station for the colliery and the village.

The Power Co., under this Order, would be able to break up streets for the purpose of laying mains, &c., and would be able to alter the position of wires, &c., of the Butterley Co. which already existed in those streets. The Butterley Co., being a non-statutory undertaking, would have inadequate protection, and the granting of the Order would place the Power Co. in a position, if it thought fit, seriously to interfere with the continuance and extension of many of the supplies now afforded by the Butterley Co. The Power Co.'s application for the Order was made in 1926, and the Butterley Co., not having observed the published advertisements relative to it, had not raised objections before the Electricity Commissioners. Subsequently, however, a memorial was submitted to the Minister of Transport, and an inquiry was held, but the Minister had confirmed the Order without amendment.

Mr. Marshall submitted that the public interest demanded that there should be further Parliamentary inquiry.

Col. G. Cox, for the Bolsover Colliery Co., Ltd., said that his clients had established generating stations at five collieries, and they were interconnected. Any interference with the lines and cables, and any interruption of the supply, would have the most serious consequences upon the working of the collieries. Although the Electric Lighting (Clauses) Act had been amended from time to time in connection with specific matters, there had been no general overhaul of the Act since it was first passed.

Mr. R. F. Parker, for the Mining Association, said that the Association represented coal owners and traders who worked and owned mines in the areas affected by the Power Co.'s Order. It had become usual for colliery companies not only to provide housing accommodation, but also to supply electricity. The fact that protection was not afforded them by the Electric Lighting (Clauses) Act, which was passed before it became the common practice to operate collieries by means of electricity, was no argument that such protection should not be afforded under the conditions obtaining at the present time. The proposal now made by the colliery companies for the insertion of adequate protective provisions was not one which the Minister of Transport would be likely to adopt without some lead from Parliament. Therefore, it was important that there should be some Parliamentary inquiry into the matter, and an authoritative decision given. In reply to the Chairman, Mr. Parker said that the kind of case which had now arisen was likely to arise all over the country.

Mr. W. A. Clark, replying on behalf of the Power Co., pointed out that there were nine local authorities whose areas were affected by the proposals in the Order, and they had all given consent. If the Butterley and Bolsover Companies had seriously apprehended injury to their apparatus as the result of the Power Co.'s operations under the Order, they should have seen the advertisements which were published when the Order was first applied for. He agreed that no special steps had been taken to bring the matter to the notice of the colliery companies; it was not the Power Co.'s place to do that. In any case, a Ministry of Transport inquiry had been held, and the case of the colliery companies had been heard fully. There were a number of collieries in the district covered by the Order, but only these two companies complained. The colliery companies had not the obligations and restrictions of a statutory undertaking, and should not have the same protection. If Parliament saw fit to grant further protection to non-statutory companies, it should be done by means of a general Act, and not through the medium of a Special Order. A further inquiry could not take place before the autumn, and the Power Co. would then be unable to give a supply in the area concerned this year.

Lord Russell, a member of the Committee, suggested that if the Committee thought that there was a case for further inquiry, the Power Co. could strike out of the area the parishes in which the Butterley and Bolsover Co.'s collieries were situated, and promote another Order in respect of those parishes next year. That would prevent the present Order being delayed.

Mr. Clark said that the colliery companies could have applied for an Order giving them power to supply, but did not want to accept the responsibilities of a statutory undertaker. The Power Co. would give the colliery companies every consideration when laying mains. It had had many applications for an immediate supply of electricity in the area covered by the Order, and the local authorities were becoming impatient. He urged that there should be no further inquiry, but that the Committee should report the Order for approval.

The Committee, having deliberated in private, concluded that there ought to be a further inquiry by a Select Committee of Parliament, and announced that it would report to that effect.

Costs of Electricity.

On July 31st, Mr. R. Richardson asked the Minister of Transport if his Department had in hand any scheme for the reduction of the cost of electricity, both for power and lighting, with a view to the reduction of cost falling upon industry and distribution.

Colonel Ashley said that the schemes recently adopted and in process of being carried out by the Central Electricity Board were directed to securing economies in the generation of electricity by the pooling of resources over wide regions. Those economies would be reflected in the price at which wholesale supplies would be available to authorised undertakers for distribution in their areas; and, in accordance with the provisions of the Act of 1926, would be further reflected in the price charged for lighting and power to individual consumers.

The Wireless and Cable Report.

On August 3rd, Mr. W. Baker (Labour) raised the question of the report of the Imperial Wireless and Cable Conference, and a number of attacks were made upon the interests concerned.

Sir John Gilmour, replying for the Government, said that whatever might be the success of the beam wireless, it had not attained either that measure of continuity of service or of secrecy which was essential to the Empire as a whole. The report came before the House after very long considerations of the problem by a body consisting of men representing a great variety of views, so far as the Dominions were concerned, some of them having to make a measure of sacrifice to attain a common purpose, and the Government having to make also the major sacrifice in order to obtain unity of purpose. This was an Empire bargain, in which they all had to take their common share and common responsibility. In so far as any sacrifice was made, it was not a sacrifice without ultimate repayment, in attaining, as he believed they would attain under the scheme, a measure of security, of secrecy, and of improvement in the commercial enterprise between the various parts of the Empire. The bargain that had been driven was a good one for the State. What were needed in the interests of the public were cheapness and efficiency. It was an established fact that, at the present time, wireless would not wholly supersede cables for all classes of traffic, and for some years to come cables would be necessary. The greatest use and benefit would be derived, in the opinion of the Conference, from the combination of the wireless and cable services, acting as a complement one to the other. The Government had decided to accept the report and to put its recommendations into effect. In doing so it felt that it was acting in the best interests of the public generally, and of the users of the services in particular. It was proposed to enter forthwith into negotiations with the companies concerned with a view to drawing up a formal agreement on the lines recommended by the Conference.

Special Orders.

Special Orders have been approved relating to the urban district of New Mills, Derby; the urban district of Brightlingsea, Essex; in respect of the compulsory acquisition of lands for a generating station in the parish of Little Barford, in the rural district of Eaton Socon, Bedford; the borough of Brackley, the rural districts of Middleton, Cheney, and Brackley, and parts of the rural districts of Daventry and Towcester, Northampton, and the borough of Buckingham, and the rural districts of Buckingham and Winslow, Buckingham; the rural district of Crick and parts of the rural districts of Brixworth and Oxendon, Northampton; the borough of Kidwelly and parts of the rural districts of Carmarthen, Llandilo Fawr, and Llanelly, Carmarthen; and the rural district of Amersham, Buckingham, and parts of the rural district of Berkhampstead, Hemel Hempstead, and Watford, Hertford.

The Prorogation.

Parliament was prorogued on Friday, August 3rd. The Prime Minister announced that it was proposed to commence the new session on November 6th.

Correspondence.

***Correspondents should forward their communications as early as possible.** No letter can be published unless we have the writer's name and address in our possession.*

Electric Refrigerators.

We should be interested to know what amount of electric refrigerator sales the average contractor has been able to obtain during the recent hot spell; our opinion is that, at the high price these articles are sold at, the only people who require them are shopkeepers, and they have been well looked after by all the manufacturers themselves, and have therefore left no room for any electrical contractor to deal with them.

Another point which arises is the fact that certain makes are sent out in an incomplete state, and require a specialist to erect them; such specialist is not supplied by the manufacturer himself, but is probably some rival contractor, in other words, certain makers expect us to hand over our business and customers to them for the purpose of being done out by trade rivals.

As the matter is at present, I am of the opinion that our only safeguard is to buy these machines direct from America, which we can do, and leave out the British maker altogether, as in hardly any case does the British manufacturer try to deal fairly with the electrical contractor; they go as far as to tell you they do not want you and will never miss you.

The Electrical Development Association should see that a proper system of fair trading is maintained. If the motor-car industry can keep itself self-contained and not allow anyone outside it to obtain goods at trade prices, why is it possible for the motor industry to obtain *all* electrical goods at trade prices?

What with the competition of power companies, municipal trading, and the fact that any person can go and buy goods at trade terms, in a very few years the electrical contractor will not be seen at all, as it is certainly impossible for him to make a living and pay heavy wages out of the profits of wiring work, which is about all he can possibly get nowadays.

It will be argued by some people that the Electrical Contractors' Association could deal with all these matters, but I should like to point out that I have been a member of the Electrical Contractors' Association since its commencement, but it does not even now possess the slightest power, or attempt to use the slightest power, for the benefit of contractors. Its only method so far has been conciliation, instead of force, and if one ever makes any comments to it about any abuses which exist in the trade one will get a very polite acknowledgment, but never hear of it again.

I have on many occasions spoken about certain abuses, but as I happen, unfortunately, to be one of the veterans of the trade, the younger ones no doubt say it "serves him right," forgetting that all such-like questions directly concern them as well.

I should like other contractors to raise a voice in this discussion, as it concerns us all.

Contractor.

July 28th, 1928.

[This letter has been shortened somewhat.—EDS. ELEC. REV.]

Does it Pay to Acquire Knowledge?

I am 32 years of age, and I have been educated at one of the foremost public schools. I am employed in a very junior position by one of the four main-line railway companies. My wages are 73s.+4s. per week, which, with overtime and deductions for privilege tickets, free passes, &c., brings my gross earnings up to approximately £223 per annum. I am very hopeful of receiving promotion at an early date, and my wages would then be 87s.+4s.; with overtime, &c., my total income would then amount to approximately £263 per annum. Owing to difficulties caused by the amalgamation, I can see no prospect whatever of receiving further promotion from my present employers.

I am most anxious to make myself worthy of filling a higher position, and with this object in view I joined the Institution of Electrical Engineers as a Graduate member nearly three years ago; I have passed the A.M.I.E.E. examination, in May, 1926. I hope to join the Institute of Transport, and I have been studying for a degree in the University of London, in my spare time. I am seriously wondering if it is worth my while to continue studying for this degree, and, if I do so, what kind of a position I can hope to get? Perhaps some of your readers would be kind enough to let me have their views on this point.

I have done a certain amount of work towards getting the B.Sc. (Engineering) degree, and it is possible that I may just manage to get this next July, but it is more probable, owing to the limited time at my disposal and other factors, that I shall not receive these honours until July, 1930.

If I do decide on pursuing a university career I will have to put in not less than 90 hours' work every week between now and then, as well as to pay my coach £6 monthly for tuition, and I will also have to pay various examination fees ranging from £2 12s. 6d. to £21. I need not point out that paying £6 monthly, as well as living away from home, is, to put it mildly, "a bit of a drag" on an income such as mine. I very much wonder if the benefits to be obtained by having a degree in these days, considering the overcrowded state of the labour market, are worth the time, trouble and money.

Ambitious.

July 28th, 1928.

Electrical Plant in Workshops.

We trust you will allow us some little space in your columns to reply to the article on "Electrical Plant in Workshops," which appeared in your issue of July 27th. Mr. J. Anderson appears to base his objection to "Safety First" devices on motor control gear on three main grounds:—(1) Expense; (2) increased difficulty of access; and (3) the fact that "there must be literally millions of these simple non-interlocked switch-fuse-starters in use all over the world."

About seven years ago an interlocked isolating switch was made a standard feature of our direct-current control panels. When standardised in this way, and not supplied as an "extra," the additional cost is small, and the demand for this "Safety First" control gear, instead of falling, due to the increased cost, has steadily risen since.

The increased difficulty of access to which Mr. Anderson refers really does not exist. To obtain access to the parts of our direct-current control panel it is only necessary to move the isolating switch to "off" and open the door, the exposed parts being then "dead."

Mr. Anderson's third point, that there are millions of simple non-interlocked starters in satisfactory use, is perhaps equally capable of being used on the other side of the argument. In spite of the fact that the full spirit of the Home Office Regulations is disregarded in this way, there is at the same time an undoubtedly increasing demand for "Safety First" control gear. This demand comes from the larger industrial undertakings which realise that, although it may be possible to disregard the regulations, it is not, taking a long view, commercially desirable to do so.

Does not the whole question come down to one of insurance? Those undertakings which simply cannot afford even a sectional stoppage and are employing large numbers of non-skilled (or at all events non-electrical) workers, find it wise to have proper isolation on the starter, and not at some other point, and they regard the extra expense as in the nature of insurance. The smaller firms, to whom a stoppage is not so serious, and who perhaps cannot afford "insurance," adopt the simpler apparatus and are content to disregard the regulations.

Perhaps on the score of expense, we may be permitted to suggest a compromise for motors up to 10 h.p. in the shape of our "Midget Faceplate" control panel, the main switch of which is made to act also as an isolator, so that at any rate the starter, no-voltage and overload releases and fuses are safe to handle when the door of the panel is open.

Brookhirst Switchgear, Ltd.,
H. M. GOODY, *Publicity Manager.*

Chester, *July 27th*, 1928.

An Engineer's Reading.

Your article under the above heading should interest a number of readers. It is strange, however, to note that, while over a dozen modern writers are referred to, no mention is made of Rudyard Kipling, who is not only considered to be Britain's greatest living writer, but has also specially devoted his genius to engineering matters. Those who have read "M'Andrew's Hymn" and "The Ship that Found Herself" will appreciate his deep knowledge of the technical details of most branches of engineering, which are also dealt with in many other of his tales and verses.

Information regarding Kipling's writings dealing with engineering, in verse and story form, will be found in certain issues of *The Kipling Journal*, the organ of the Kipling Society, and details of this Society can be obtained from me.

J. H. C. Brooking.

Blackheath, *July 30th*, 1928.

Output, Load Factor and Efficiency.

In your July 20th issue, "Accountant" quotes from the ELECTRICAL REVIEW of August 13th, 1920, as follows:—If the "Parsons Law" is true, the coal consumption is unaffected by load factor.

In reply, I would suggest that the Parsons line is true only for the particular fuel-heat value from which the values comprising the equation are deduced. It is evident that with two fuels, one with a heat content of, say, 10,000 B.th.u., and the other 14,000 B.th.u. per lb., with the same steam production efficiency applying in each case, the fuel consump

tions for the same steam output would bear the ratio 1.4 to 1.0, although the initial heat expenditure is the same in each case.

Any wide variation in the fuel-heat value necessitates an alteration in the no-load fuel consumption and the datum fuel figure values, or, better still, the introduction of a correction factor, which would cut out the necessity for a Parsons line for each specific fuel-heat value.

By basing the fuel figures in the equation on a fixed heat value, say, 10,000 B.th.u., and adopting what may be termed the factor of equivalent heat value, obtained in this case by dividing 10,000 by the fuel-heat value, the necessary correction is applied and one Parsons line suffices for a wide range of fuel-heat values.

William D. Wylde.

Southsea, *July 30th*, 1928.

The Production of H.P. Cables.

In your issue of July 27th you abstracted an article by Dr. P. Junius in the *E.T.Z.* describing a method of controlling the drying and impregnation of high-pressure power cables.

In view of the emphasis laid in your editorial comments on the necessity for British research, may I point out that in this instance the British research has been carried out in advance of the German. The method described has been in use in the works of the Standard Telephones & Cables, Ltd., for some years and is covered by British patent 276,271. A brief description of the method was included in a paper on "Insulating Oils" read before the I.E.E. by Messrs. T. N. Riley and T. R. Scott, and abstracted in your issue of March 16th, 1928, p. 486.

The greater control of operations afforded is undoubtedly a valuable feature in producing high-quality cables.

H. J. Herink,
Chief Engineer,
Standard Telephones & Cables, Ltd.

London, *July 30th*, 1928.

I read with interest a short article in your issue of July 27th describing a system of testing high-voltage cables during the process of drying and impregnation.

From the final paragraph of the article I conclude that this refinement is regarded as an innovation, at least on the Continent. I am glad, however, to be able to state that in this particular this country forestalled our methodical Continental rivals. Nearly eighteen months ago a system of testing during drying and impregnation was put into practice in the super-tension cables department of Messrs. Siemens Bros. & Co., Ltd., Woolwich, largely at my instigation.

The observations made serve as an admirable guide to the progress of both drying and impregnation. The arrangement is, as stated, very sensitive to changes of temperature; so much so that irregularities in this respect render the tests almost useless. It is essential, in order to get the full use of the process, to fit temperature recorders to the impregnating tanks.

M. C. Timins.

Leeds, *July 30th*, 1928.

Earthing and the Public.

Why this worry regarding earthing of fittings—surely we may be guided by presumably the best practice, as exists in a London hotel, not a stone's throw from Mayfair?

One's head touches the lampholder when standing in the bath. Double-pole fuses, "all alive oh"; poles ¾ inch apart, less covers, at floor level and conveniently placed for making contact with bare feet in bedrooms. Radiator alive to ground when the switch is open, and all at a comfortable voltage of 245 V as actually measured.

Delightful accommodation for children, colonials, or country cousins!

Blissful.

July 27th, 1928.

Selected and Non-Selected Stations.

I am quite sure there are many of your readers who will be disappointed, on receiving their Electrical Review of to-day's date, to find that there is no reply to "City Electrical Engineer" on the above subject; I for one am still hoping for it, and, in addition, for a clear description of "Selected and Non-Selected Stations."

It would be very interesting to have a clear statement of the position of electrical generating stations, "Selected and Non-Selected," with "Special Orders," and without "Special Orders."

Small Power Station.

August 4th, 1928.

The Value of Research.

Your leading article in your July 27th issue will be endorsed by everyone engaged in research and invention, and it is to be hoped that your warning note will have a salutary effect upon those in control of the financial side of the industry.

To the average financial man in this country the word research appears to be anathema; if he tolerates anything of the kind, he expects discoveries to be made to a time-table and turned into money forthwith. The attitude towards inventions is still worse; the inventor is expected to carry out all the spade work at his own expense, and then hand everything over on a plate in return for a mess of pottage. Further, if his idea can be "got round," and he can be denied even the mess of pottage, that is considered good business by some. Even the Patent Office adopts a niggardly attitude towards inventors by charging excessive fees, out of which the Treasury takes some £100,000 per annum, money which would be much better employed in research work. Small wonder then, that many British inventors, finding foreign firms more appreciative and enterprising, are exporting their ideas, knowing that when they have been fully developed abroad, British firms will have to come to terms in order to bring themselves up-to-date. "A prophet is not without honour, &c."

A. W. Empson.

London, *July 30th*, 1928.

Rating and Valuation (Apportionment) Bill, 1928.

The above Bill, which passed third reading in the House of Lords on the 1st inst., places yet another difficulty in the way of those whose business it is to develop the public supply of electricity in this country.

The relief obtainable, when the provisions of the Bill come into operation, undoubtedly will prove of benefit to a variety of industries, some of which at the present time are prosperous, while others are suffering acute depression.

Although there was considerable criticism of the Government's policy which culminated in the passing of the Electricity (Supply) Act, 1926, those engaged in the electricity supply industry rightly decided to do all in their power loyally to support the Central Electricity Board, upon which devolves the responsibility of carrying out the various schemes adopted in accordance with the provisions of that Act.

The success of the Government's adopted policy will, to a great extent, be prejudiced if existing privately-owned generating stations continue in operation, and if new private stations are brought into being. The Rating Bill, however, in effect, puts a premium on such stations in that the proposed rates rebate of 75 per cent. to factories will apply to privately-owned stations within those factories, whereas public supply undertakings are specifically excluded from any benefits under the Bill.

To illustrate this point, I would cite the case of two similar factories, one of which receives a supply from a public source—and may, therefore, be said to be working in with the national scheme—and the other produces its own power. The latter will enjoy the benefit of a rates rebate, which is not open to the former.

It would appear, therefore, that the Government, after having passed the Electricity (Supply) Act, 1926, is now giving encouragement to private generation, which cannot but prove detrimental to the successful carrying-out of its earlier policy.

It is, to say the least of it, discouraging to find that, in spite of representations made to the Ministries of Health and Transport by a deputation representative of the whole of the electricity supply industry, and after discussion of the matter in both Houses of Parliament, the Bill has been passed without amendment in this respect.

This added difficulty in the way of development of the public supply of electricity, which is already over-burdened with restrictive legislation and regulations, makes it all the more necessary for those concerned to press for relaxation of some of these hampering restrictions.

R. P. Sloan,
Managing Director,
Newcastle-upon-Tyne Electric Supply Co., Ltd.

Newcastle-upon-Tyne, *August 3rd*, 1928.

Regulations for Overhead Lines.

In the interesting article on "Regulations for Overhead Lines" in your issue of August 3rd, reference is made to the behaviour of copper wire when stressed above the limit of elasticity, and it is claimed as a new discovery by certain Swedish engineers that the limit of proportionality may be substantially increased in this way.

May I call attention to the fact that in the Report of the British Engineering and Allied Industries Research Association upon tests on hard-drawn copper wires and cables, published in Volume 61 of the *Journal* of the Institution of Electrical Engineers in 1923, reference is made to tests indicating this property of copper wire, and I think, therefore, that the Research Association may claim priority in recording this particular phenomenon.

W. B. Woodhouse.

Leeds, *August 4th*, 1928.

Legal.

Clarke v. McCullum.

IN the King's Bench Division, on July 30th, before Mr. Justice Finlay, Mr. John H. Clarke brought an action against Mr. J. McCullum to enforce the specific performance of an agreement providing that the plaintiff, in return for his services, should be allotted shares in a company. It was stated that the plaintiff, under instructions from Mr. T. Petersen, of Callender's Cable & Construction Co., Ltd., conducted a test of defendant's invention of a method of conserving steam. He reported favourably upon the invention to Mr. Robert Petersen, and Mr. Petersen and the defendant announced their intention of forming a company to exploit it. It was arranged that the plaintiff should act in an advisory capacity to the company and that Mr. Petersen should transfer to him a number of shares, while a similar number would be transferred to him by the defendant. The company, The Steam Heat Conservation Co., Ltd., was duly registered, and the plaintiff rendered services to it. Mr. Petersen duly allotted him 1,000 1s. shares, but the defendant sought to repudiate his liability to do the same.

Mr. MCCULLUM, giving evidence, denied that there was an agreement or that the plaintiff had rendered the services claimed. He said that if the services had been rendered it was at the request of Mr. R. Petersen. After plaintiff had given evidence in support of his claim, there was a consultation between the parties' counsel, and Mr. CROOM-JOHNSON said that although his client, the defendant, maintained that there was no contract, he recognised that he had made a promise, and intended to fulfil it; but when he was threatened with an action he did not feel inclined to transfer any shares. As a compromise, although the promise was not of a legal nature, he was willing to transfer 500 1s. shares to the plaintiff, provided each party paid his own costs. His LORDSHIP considered that that was a reasonable compromise.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

6,694. "Electric discharge tubes." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). March 10th, 1927. (293,711.)

6,837. "Evacuation of vacuum electric-tube devices." E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. March 11th, 1927. (293,723.)

6,910. "Electric power transmission." A. M. Taylor. March 12th, 1927. (Addition to 277,049.) (Cognate applications, 7,373/27, 10,107/27, 22,921/27, and 23,141/27.) (293,811.)

9,597. "Manufacture of electrical resistance elements." General Electric Co., Ltd., and C. J. Smithells. April 7th, 1927. (293,728.)

9,674. "Gas-cocks, electric switches and the like." Horstmann Gear Co., Ltd., and A. Horstmann. April 8th, 1927. (293,714.)

9,682. "Method for the electrodeposition of rubber or the like." W. A. Williams. April 8th, 1927. (293,815.)

9,899. "Resistance lamps." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). April 11th, 1927. (293,894.)

9,901. "High-tension cables." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). April 11th, 1927. (293,731.)

9,902. "Battery-charging equipment." Associated Telephone & Telegraph Co. July 10th, 1926. (274,038.)

9,968. "Automatic telephone and other remote-control systems and switching apparatus therefor." H. Baron (legal representative of F. Aldendorff (deceased). April 11th, 1927. (293,737.)

10,204. "Adjustment devices intended for use more particularly with wireless apparatus." R. Atkins, A. E. Frearson, and Ormond Engineering Co., Ltd. April 13th, 1927. (293,821.)

10,221. "Sound-amplifying horns or the like." F. A. Boyd. April 13th, 1927. (Cognate application 15,751/27.) (293,822.)

10,335. "Dynamo-electric machines." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. April 14th, 1927 (293,901.)

10,515. "Electrical method of, and means for the preventing of, corrosion and for the indication of faults in the associated circuits." E. Cumberland. April 19th, 1927. (Addition to 277,417.) (293,909.)

10,554. "Electric inductances." E. C. Howell, B. M. Howell, E. C. L. Howell, and D. G. Howell (trading as Howell & Co.). April 20th, 1927. (293,910.)

10,565. "Telephonic or like receiving devices." H. K. de Lacy. April 20th, 1927. (293,911.)

10,588. "Sound-amplifying horns and method of producing sound-amplifying horns." J. B. Hawley. April 20th, 1927. (293,912.)

10,670. "Remote-control mechanism." W. E. Barbour, H. A. Watts, and E. Hoyle. April 20th, 1927. (293,915.)

10,730. "Electrically-propelled vehicles." R. C. Mortimer and Metropolitan-Vickers Electrical Co., Ltd. April 21st, 1927. (293,918.)

10,927. "Brush mechanism for dynamo-electric machines." British Thomson-Houston Co., Ltd. April 26th, 1926. (269,930.)

11,164. "Radio apparatus." Burndept Wireless, Ltd., and C. F. Phillips. April 26th, 1927. (293,926.)

11,458. "Art of galvanoplasty." United Products Corporation of America. July 3rd, 1926. (273,364.)

11,675. "Holders for thermionic valves." Dr. S. Loewe. April 30th, 1926. (270,344.)

12,651. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. H. Maggs. May 11th, 1927. (293,936.)

13,037. "Rectifying discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 20th, 1926. (271,466.)

13,505. "Rotary electric circuit controllers." British Power Railway Signal Co., Ltd., S. L. Glenn, and E. E. Pierce. May 19th, 1927. (293,943.)

13,930. "Electric batteries or accumulators." G. H. Trotter. May 24th, 1927. (293,945.)

14,616. "Adjustable electric-light sconce fittings." J. E. Swann, W. G. Hutchings, and H. W. Hayes. May 31st, 1927. (293,949.)

14,807. "Sparking plugs for internal-combustion engines." K. E. L. Guinness. June 2nd, 1927. (293,950.)

14,985. "Swivel joint for lighting system." P. M. Hotchkin. June 7th, 1927. (293,952.)

16,050. "Indicating or measuring devices for high-frequency currents." Dubilier Condenser Co. (1925), Ltd. September 24th, 1926. (277,933.)

16,863. "Electrode mountings for vacuum electric tube devices." Westinghouse Electric & Manufacturing Co., Ltd. July 3rd, 1926. (273,699.)

17,972. "Thermionic valves or electron discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 27th, 1927. (289,417.)

18,873. "Ignition systems for internal-combustion engines." J. B. Budd. July 16th, 1927. (293,978.)

19,076. "Wireless telephone receivers." P. Rabridge. July 16th, 1926. (274,511.)

19,255. "Contact plugs of sheet or strip metal, particularly for radio purposes." O. Langlotz and R. Liebergeld (trading as Langlotz & Co. Fabrik Elektrotechnischer Bedarfsartikel). July 20th, 1926. (274,874.)

20,203. "Manufacture of electrical resistance elements." General Electric Co., Ltd., and C. J. Smithells. April 7th, 1927. (Divided application on 293,728.) (293,740.)

20,776. "Cable suspension for electric railways." F. Berg. August 6th, 1927. (293,993.)

21,199. "Control-wheel with indicating device for arc-welding plants." R. Sarazin. October 5th, 1926. (278,676.)

22,399. "Direction-indicator switch boxes." A. R. P. Johnson. August 25th, 1927. (294,004.)

23,366. "Electrical switch mechanism." W. Rea. September 6th, 1927. (294,010.)

23,647. "Induction furnaces or heating devices." Siemens & Halske Akt.-Ges. September 11th, 1926. (Addition to 274,888.) (277,352.)

23,784. "Ironless induction furnaces or heating apparatus." Siemens and Halske Akt.-Ges. September 11th, 1926. (Addition to 274,888.) (277,361.)

26,252. "Cable and other telegraphic transmission and reception." H. Walter. October 5th, 1927. (294,022.)

26,936. "Elevators." O. Y. Imray (Shur-Loc Elevator Safety Corporation). October 11th, 1927. (294,025.)

27,276. "Method for compensating the influences of temperature on sound-emitting devices." H. J. Kuchenmeister. October 15th, 1926. (279,101.)

28,153. "Magnetic chucks." A. Humphreys. October 22nd, 1927. (294,030.)

30,491. "Method for obtaining a very high vacuum." Dr. S. Loewe. November 16th, 1926. (280,908.)

32,309. "Automatic regulation of electric transformers." E. C. R. Marks (legal representative of M. Doloukhanoff (deceased). January 4th, 1926. (Divided application on 263,884.) (281,680.)

33,190. "Electric plug-or-socket connectors." Santon, Ltd., and H. C. Sanders. December 8th, 1927. (294,047.)

34,273. "Radio-receiver circuit with piezo-electrical resonator." W. Kunze and Radio-frequenz Ges. December 18th, 1926. (282,444.)

34,434. "Alternating-current potentiometers." A. Campbell. December 20th, 1927. (Addition to 244,596.) (294,053.)

35,031. "Magneto-electric lighting machine." L. Hemmeler. January 3rd, 1927. (283,110.)

35,294. "Light-screening device." A. E. Mason. February 6th, 1928. (294,059.)

35,412. "Operation of loud-speakers." C. Dehaene. October 4th, 1927. (294,060.)

35,473. "Crystal-controlled high-power oscillators and amplifiers." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). December 31st, 1927. (294,061.)

1928.

516. "Thermionic amplifiers, detectors, and the like." Marconi's Wireless Telegraph Co., Ltd. January 7th, 1927. (283,219.)

863. "Asynchronous three-phase motor with asynchronous starting motor." Sachsenwerk Licht-und Kraft-Akt.-Ges. March 15th, 1927. (287,101.)

2,611. "Switching devices for use in high-frequency circuits." Marconi's Wireless Telegraph Co., Ltd. January 27th, 1927. (284,293.)

2,721. "Circuit arrangement for non-numerical switches in telephone systems." Siemens & Halske Akt.-Ges. February 5th, 1927. (284,699.)

4,976. "Electrical watch." Comptoir General de Vente de la Montre Roskopf Soc. Anon. Vve C. L. Schmid et Cie. February 18th, 1927. (285,493.)

5,612. "Impulse transmitter for automatic telephone installations." Siemens & Halske Akt.-Ges. April 27th, 1927. (289,423.)

8,778. "Thermionic amplifiers, frequency-changers, and the like." Marconi's Wireless Telegraph Co., Ltd. March 23rd, 1927. (287,532.)

8,865. "Loud-speakers." Etablissements E Belin. March 24th, 1927. (287,570.)

9,003. "Apparatus for picture telegraphy.' C. Lorenz Akt.-Ges. April 23rd, 1927. (289,061.)

11,905. "Picture telegraph and the like apparatus." Telefunken Ges. für Drahtlose Telegraphie. April 21st, 1927. (289,096.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 1st :—

Oralac. No. 492,715. Class 1. Varnish for insulating purposes.—The London Electric Wire Co. & Smiths, Ltd., 7, Playhouse Yard, Golden Lane, E.C.2.

Hyton. No. 489,048. Class 8. Apparatus and parts for use in wireless telegraphy and telephony, but not including electric storage batteries, accumulators, &c.—F. Boyd, 17, Albert Street, N.W.1.

Lionium. No. 490,347. Class 8. Rectifiers for alternating electric current.—Blackwells Metallurgical Works, Ltd., The Albany, Oldhall Street, Liverpool.

Staric. No. 490,992. All goods in Class 8.—La Société de Construction d'Appareillages et Specialites Electriques, 78, Rue Fondary, Paris, and 10-12, Ludgate Hill, E.C.4.

Radio Communication Co., Ltd. (lettering and design). No. 492,195. Class 8. Apparatus for use in connection with wireless telegraphy and telephony.—Radio Communication Co., Ltd., 34-35, Norfolk Street, Strand, W.C.2.

Thistle. No. 491,066. Class 8. Wireless telephonic receiving apparatus.—Laurence Best, 33, George Street, Edinburgh.

Cronlite (lettering and design). No. 491,632. Class 8. Electric flash lamps and electric torches.—Ward & Goldstone, Ltd., Sampson Works, Frederick Road, Pendleton, Manchester.

Lozalit. No. 492,125. Class 11. Electrical insulators made of baked clay.—The Sprenger Corporation, 30, Norfolk Street, Strand, W.C.2.

Nonox (lettering and design). No. 489,368. Class 18. Electric lighting installations for vehicles, ships and aircraft.—La Société Magnetos Lucifer, 14, Route de St. Julien, Carouge, near Geneva, Switzerland. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Ruston. No. 490,713. Class 18. Electric lighting plants.—Ruston and Hornsby, Ltd., Sheaf Ironworks, Lincoln.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHFORD.—Central schools for Kent E.C.; E. Salter Davies, director of education, Sessions House, Maidstone.

ASHTON HAYES (Cheshire).—Electric light installation, Church of St. John the Evangelist; Rev. W. B. Canton, vicar.

BECKENHAM.—Boys' secondary school, for Kent E.C.; education architect, Sessions House, Maidstone.

BLACKPOOL.—Garage (£60,000); Sir Lindsay Parkinson and Co.

BOLTON.—Reconstruction weaving shed, Lincoln Mills, Washington Street; R. Entwistle & Co., Ltd. Extensions Nurses' Home, Chotley New Road; Bolton and District Nursing Association. Extensions, Eagle Mills, John Street; Bolton Eagle Spinning Co., Ltd.

BRIGHTON.—Boys' secondary school (£65,700), for the Borough E.C.; director of education.

BRISTOL.—Housing scheme (170), Fishponds, for the T.C., by direct labour; city surveyor. New schemes for about 10,000 houses on various sites; Estates Department. Baptist church, Fishponds Estate; Baptist trustees. Extensions, oil depôt, Royal Edward Dock; Russian Oil Products, Ltd.

CHELTENHAM.—Extensions, saw mills, Great Norwood Street; F. Parry. Alterations and additions, Roderic House, Suffolk Square; Ladies' College Council.

COVENTRY.—Re-erection (after fire) of mill premises, for G. Newark & Son, timber merchants.

DARTFORD.—Technical college for Kent E.C.; E. Salter Davies, director of education, Sessions House, Maidstone.

DEVONPORT.—Secondary school, Bladderley Lane; Plymouth Education Committee.

DOVER.—Workshops, Glenfield Road; St. Dunstan's Association for the Blind.

DUMFRIES.—Warehouse and offices (£2,500), for Mr. Kirkpatrick Dobie, grain merchant, 28, Queensberry Street; J. E. Blacklock, solicitor.

DUNDEE.—120 houses for Corporation (£39,295); Charles Jones & Co., contractors, Glasgow.

EASTWOOD (Notts.).—Kinema, Hill Top; F. G. Stubbs.

ELLAND.—Additional 25 houses for the U.D.C.; surveyor.

FARNWORTH.—Housing scheme (36), Daisy Avenue (deposit £2); F. Ashton, engineer, Town Hall.

FYFIELD.—School (£12,770), for Essex E.C.; H. C. Horswill, Ltd., builders.

GILLINGHAM (Kent).—Printing works, Barnsole Road, for A. J. Tull; E. J. Hammond, architect.

HAMILTON.—Garage and workshops, Burnbank Road, for J. W. & R. Torrance, motor engineers; Mr. Cullen, architect.

HASTINGS.—Alterations, Grosvenor Works, Bexhill Road; H. Ward & Son, architects.

HEMSWORTH.—Laundry machinery for Brierley Isolation Hospital (August 13th); W. T. Lynam, engineer to James Hospital Committee, Market Chambers.

HEYWOOD.—Housing scheme, Egerton Street and Wilton's Extent (deposit £1 1s.); J. B. Nuttall, borough surveyor, Municipal Buildings.

HULL.—Maternity hospital, Hedon Road; Medical Officer of Health. Extensions, Central Library (£15,694), for the T.C.; J. Houlton & Sons, Ltd., builders. Houses (112), for the T.C.; J. H. Fenwick & Son, Ltd., builders.

IRLAM.—Housing scheme (50), Lords Street site, Cadishead (deposit £2); surveyor to U.D.C.

LEEDS.—30 houses, The Drive, Lidgett Park Road, Roundhay; A. T. Lazenby. 30 shops, Woodlands Estate; trustees of Joseph Pickersgill. 42 houses, Bowood Crescent, Meanwood; H. Broadbent. Offices at Market Buildings; city engineer. 52 houses, Green Hill Lane, Wortley; J. Thirtle. Extensions, Meanwood Park Colony; H. Carter Pegg, architect, London. Cinema, Well Lane, Chapel Allerton; H. W. Thwaites.

LEICESTER.—Mental hospital, Leicester Frith (£18,600); city architect. Reconstruction, Belgrave Baths (£14,000); city engineer.

LONDON (Hackney, E.).—44 tenements, Shore Estate; L.C.C. architect.

(Ilford, E.).—Offices, &c., Ship Carbon Co., Ltd., Grove Road; J. T. Luton & Son, Ltd.

(Stepney, E.).—Garage at depôt (£9,000); borough engineer.

(Southwark, S.E.).—Buildings for Cornwall Press, Ltd., Paris Gardens; A. Drew.

(Hammersmith, S.W.).—Tenements (80) for the B.C. (£37,810); A. Pascall & Son, contractors.

(Kensington, S.W.).—Further extensions, High Street; J. Barker & Co., Ltd.

MANCHESTER.—Erection and equipment of elementary school (£91,500); Education Committee. Erection of North Manchester High School for Boys (£54,500); Education Committee. Extensions, salvage plant, Water Street depôt; city architect.

MANSFIELD.—School, for the Borough E.C.; clerk. Additional 50 houses, Ravensdale Estate, for the T.C.; borough surveyor. Testing shop, Littleworth, for the Meadow Foundry Co., Ltd.

MISTLEY.—Extensions, Brunswick Hospital, for L.C.C.; A. Evans & Co., Clacton.

MORDEN.—Development, L.C.C. Estate, 3,000 houses; C. J. Wills & Sons, Ltd.

MORECAMBE.—Town hall; Special Corporation Committee.

NORTHAMPTON.—20 bedrooms, General Hospital; governors. Extensions, New Theatre, Abington Street; Northampton Theatre Syndicate, Ltd. Warehouse, The Riding; E. Archer & Sons, Ltd.

NOTTINGHAM.—Extensions, County Offices; Notts. C.C.

OLLERTON.—Elementary school (£8,757); Coleman & Blackburn, East Kirby.

PLYMOUTH.—Laboratories and workshops, Junior Technical School, Durnford Street; Education Committee. Workshop and offices, Cemetery Road; J. Geach & Sons. Lecture hall and billiard room, Eric Road; A. J. Wilkins.

PORTSMOUTH.—School with electric light and heating work (£7,503), for the Borough E.C.; Tanner Bros., builders. Extensions to Mental Hospital (£62,000), for the T.C.; borough surveyor. Extensions to City Hospital, with central heating, for the governors; secretary.

RAWMARSH.—Housing scheme (100), for the U.D.C.; Jeffrey A. Tonge, architect, Parkgate (returnable deposit of £2).

RUGBY.—Electric greyhound racing track, for Albion Greyhounds (Watford), Ltd.; S. J. Weaver, secretary, Essex Chambers, Clarendon Road.

ST. HELENS (Lancs.).—Kinema, with lift (£25,000), for P. J. Conroy, Wigan.

SANDBACH (Cheshire).—Electric light installation, Parish Church; Rev. J. H. Armitstead, vicar.

SCUNTHORPE.—Reconstruction of sewage disposal works; W. Farrar, engineer, Council Offices.

SEDBURGH (Kendal).—Re-erection (after fire) of Ingmire Hall, for Capt. Waller, Keighley.

SHEFFIELD.—Social institute, Prince of Wales Road (£16,000); city architect. 122 houses, Longley Estate; city architect.

SOUTHAMPTON.—Re-erection (after fire) of Durley Sawmills, for F. Houghton, Ltd. (£10,000 to £15,000).

SOUTHPORT.—Extensions, King George V School (£5,033), for the Borough E.C.; director of education.

STURMINSTER.—Housing scheme (36), for the R.D.C.; G. F. Hazell, architect, Bath Road, Sturminster Newton (returnable deposit of £2 2s.).

SWANSCOMBE.—Finishing department, New Northfleet Paper Mills; Simpson, McMichael & Davidson.

TARLETON.—School (£13,635), for Lancs. E.C.; county architect, Preston.

TORQUAY.—Houses (30), West Hill Road, for E. H. Goss.

WALLINGTON.—Block of shops and offices, Manor Road, for W. T. Wheeler. Factory, London Road, for the Mitcham Motor Co.

YORK.—136 houses, Tang Hall Estate; city engineer. Technical school, Clifford Street (£5,000); Education Committee. Additions, Coney Street; *Yorkshire Herald* Newspaper Co.